PROJECT THESIS

ON

DECISION MAKING- INVESTMENT, FINANCIAL & RISK ANALYSIS IN MINING PROJECTS

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF

MASTER OF TECHNOLOGY (DUAL DEGREE)

IN

MINING ENGINEERING

BY

SHAILESH MAHAPATRO

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DEPARTMENT OF MINING ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY

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CERTIFICATE

This is to certify that the thesis entitled "DECISION MAKING- INVESTMENT, FINANCIAL & RISK ANALYSIS IN MINING PROJECTS" submitted by Sri Shailesh Mahapatro (Roll No 710MN1163) in partial fulfillment of the requirements for the award of Master of Technology degree in Mining Engineering at the National Institute of Technology, Rourkela is an authentic work carried out by him under my supervision and guidance.

To the best of my knowledge, the matter embodied in this thesis has not formed the basis for the award of any Degree or Diploma or similar title of any University or Institution.

DATE:

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ACKNOWLEDGEMENT

I am highly thrilled to offer my gratitude to all those individuals who one way or the other extended their valuable assistance towards the preparation & completion of this project. Without their needful guidance it would have been impossible for me to compile this dissertation.

First and foremost, I would like to express my deepest gratitude to my project guide, Prof. B.K. Pal for allowing me to pursue in this topic of my choice and also for his guidance, constructive criticism and valuable suggestion throughout the course of my work. I am highly thankful to him for giving his valuable time and knowledge which has led to my better understanding of my project work and also to its timely completion.

A word of thanks for the Head of the department for allowing me to visit mines and other relevant places for data collection and to the entire Faculty, Staff's and Students of Department of Mining Engineering who have helped me for carrying out my work.

I would also like to thank the management of Lajkura Opencast Project for being so cooperative in nature and for providing me all the necessary data required for the project work.

Last but not the least, I would thank all my friends and family for being supportive and helpful during my accomplishment of this dissertation.

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ABSTRACT

When it comes to mining it is well-known that the investment projects in this industry involves substantial amount of capital, long time periods, sequential decision making related to investment strategies and also a complex mosaic of various unknown factors which affects the value of a project. Apart from that the mining projects also consists of a number of geological, economic, environmental, social, technological as well as financial risks. It is very difficult to predict and evaluate these risks well in advance unless a thorough analysis is carried out. So it shows a project value, as a function of random variables is a random variable itself. In India, the Coal mining Industry is one of the major business area and in the recent time, it came to limelight due to the Coalgate scam and Government cancelling the allocation of 204 out of 218 coal blocks. So an in-depth analysis of this industry was the need of the hour.

In this project we have dealt with the three most important aspects i.e. financial, investment and risk part on which the project feasibility depends. First we did the financial analysis of the 8 major coal mining companies in India and studied their financial positions by comparing and evaluating their financial ratios. 20 financial ratios are taken which depicted the liquidity, solvency, profitability and operational turnover capacity of the companies. Then the investment analysis of three variants of the Lajkura project of MCL was performed using the traditional capital budgeting techniques like NPV, IRR (both financial and economic) and Profitability Index. Before that a thorough study of all the cash flow data, unit cost estimates, economic analysis etc. of the three Variants were properly made. After the investment analysis part, the risk analysis was performed on the most efficient variant of the Lajkura project. The Monte Carlo simulation was implemented after using the basic data and assumptions of the Variant. 10000 NPV data were generated and analyzed. Many statistical tools were used to have a profound knowledge of the risk involved in the project. Then according to the results of all the three analysis processes final conclusion was given.

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
NPV	Net Present Value
IRR	Internal Rate of Return
PI	Profitability Index
ARR	Accounting Rate of Return
DCF	Discounted Cash Flow
PB	Pay Back
ROV	Real Options Valuation
PV	Present Value
FV	Future Value
FIRR	Financial Internal Rate of Return
EIRR	Economic Internal Rate of Return
CIL	Coal India Limited
MCL	Mahanadi Coalfield Limited
SCCL	Singareni Collieries Company Limited
GMDC	Gujarat Mineral Development Corporation
NLC	Neyvili Lignite Corporation
BEP	Break Even Point
OB	Over burden
OCP	Open Cast Project
WACC	Weighted Average Cost of capital
CAPM	Capital Asset Pricing Model
ROA	Return on Assets
ROI	Return on Investment
ROE	Return on Equity
ROCE	Return on Capital Employed
MTY	Million Ton per Year
HEMM	Heavy earth Moving Machinery
EBIT	Earnings before Interest and Tax
PERT	Program Evaluation and Review Technique

CHAPTER 1

INTRODUCTION

1.1 Brief Introduction

Evaluation of the capital investments in mining projects is a type of specific measurement method on the terms of benefit and cost ratio within a predetermined duration of project. Each of the evaluation method tries to explain and support the acceptability or unacceptability of an investment project taken into consideration. Before two decades, technical skills were considered to be the primary ingredient for an efficient management in the mining industry. With the change in system trends and the internalization of the world industry, there has been a drastic change in perception in the mining management. Now technical skills need to be well supplemented with other non-technical skills like financial and risk forecasting.

For the optimization of profitability and a better management of the mining company, we need to have an in-depth knowledge about the economic aspects of all the mine functioning units. Engineering economics deals with the methods that enables a person to take decision towards minimizing the cost associated and maximizing the benefits to the business organization. Time to time the cost and financial risk analysis need to be done with the helping aid of the financial statements, capital budgeting techniques, simulation methods etc. The more all-round detailed analysis we execute, the more authentic and reliable the projects be in terms of all major kinds of risk.

Risks associated with the technical and commercial aspects of mining investments have always remained high. There is huge amount of uncertainty due to the economic and market conditions; tax policies, interest rate type government policies and also the international conditions. When we consider the available investment opportunities, we try to determine which projects will maximize the value of the company and maximize its owner's wealth. So we analyze each project evaluating how much its benefits exceed the cost. The cash flow values and the opportunity costs are mainly scrutinized during the process. Other important aspects are also considered during the decision making and then the best project of all is chosen.

1.2 Objectives

- To provide proper knowledge of economical concepts and various capital budgeting techniques with their advantages and disadvantages.
- To implement the economic valuation techniques on a mining project after collecting all the relevant data required for it and then take decisions accordingly.
- To understand the terms in a financial statement, financial ratios etc. used for a company's financial condition analysis along with the significance of each ratio.
- Calculate the financial ratios of important coal mining companies and compare their financial conditions in the last 2 years.
- To learn and then perform the Monte Carlo Simulation in the mining project used above and perform its risk analysis.
- To integrate all these analysis to make economically sound planning and investment decisions by minimizing the risk.

1.3 Methodology

- The topic and area of work for the Project is decided.
- Having a sound knowledge of the topic by searching and studying the literature from various sources on the topic
- Making a layout of the areas and work to be covered in the project.
- Gathering data from internet, libraries, mining companies and other sources.
- Completing the financial analysis by using the financial data from annual reports, comparing them and finding the results.
- Using the data from the Lajkura project, the Investment analysis part was completed and the results were mentioned.
- By the help of Monte Carlo simulation the risk analysis was done on the data from the Lajkura project for one of the ongoing project, i.e. Variant 3.
- From all the three areas the conclusion was derived for making an economically sound decision for project where less risk is involved.
- Finally all the above work is compiled in the form of a thesis and presented to the authorities.

CHAPTER 2

LITERATURE REVIEW

1. **Andrea Gamba (2003)[8]** in his paper provides approach for valuing capital budgeting problems with real option dependent many state variables along with a valuation algorithm using Monte Carlo Simulation. The valuation approach decomposes a complex option problem into a set of simple options but taking into account deviations from value additivity due to embedded real option. They provided an array of numerical results showing convergence of algorithm and a few real life capital budgeting problems which could be solved by this approach
2. **Cvjetko Stojanovic (2013)[16]** in his paper provides an overview of dynamic methods for evaluating investment projects in the mining industry along with the application examples which are currently in practice. For the dynamic assessment of investment efficiency it uses the basis methods like Payback period, NPV and IRR for the project equipment investments. The economic efficiency evaluation of replacement of mining equipment is provided for specific conditions of Bogutovo Selo open-pit mine in Bosnia while the combined NPV methods and Real options method was used in techno-economic evaluation of investment project for Radljevo deposit in Kolubara basin, Serbia. A reliability analysis was performed for the entire selected equipment using reliable data and the development of mining was optimized by using simulation method.
3. **David E. Stout; Xie Alice, Yan; Qi Howard, (2008)[7]** in their article provides us with a tool to supplement discounted cash flow (DCF) analysis with that of real options. They used an example of a Rental Car Company which is considering for the purchase of a new car for its rental fleet. Here the management is contemplating on whether to buy a conventional gasoline-engine automobile or a hybrid vehicle. Within this decision they have also illustrated the embedded options the company should consider for the given uncertainty of a new energy bill which offers income tax credits to the purchase of commercially operated hybrid vehicle. Their step by step approach gives information for incorporating these real options suitably into the capital budgeting process.
4. **Debasish Mohapatra, (2009)[12]** covers all the basics of a cost effective mining scenario. It included the economics of the various mining information as well as steps for rational

mining project evaluation. The project addresses the DCF techniques and its application in an operating mine environment. A real life mining case study i.e. (Bhubaneswari OCP) is taken and the balance sheet is analyzed for preparing a cash flow statement for the mine. It also gives information about the computational approach for the investment analysis using C++ programs for different budgeting techniques. It also deal with strategic mine management, mine valuation and the risk analysis part in theory.

5. **D.G. Krige (1972)[9]** discussed in detail about the capital investment and risk analysis for a new mining project. It mentioned the different criteria for assessing returns on investment including the decision factors and the risk factors. It considered the financial model which covered the preproduction period, production period and the rate of return. The practical application of the model like the viability of a project, best physical plan and how the project be financed to best advantage were studied. The Gearing ratio and loan terms were used during the decision making. These were possible due to the availability of the risk analysis computer program.
6. **Jason Hall, Shannon Nicholls (2007)[10]** mention that the standard DCF methods are now supplemented by the real options valuation in corporate finance including the mining industry. It states that managers who ignores these options are likely to arrive at valuations below those typically seen in market. They illustrated the difference between DCF and ROV by implementing on equity markets, oil, plantations, land, Gold, Copper etc. The ROV has the option to change the size and scope of the project. By citing an example of the valuation of a coal mine they mentioned us the various alternatives which we have while using the ROV. This is the most appropriate approach provided the probabilities used in estimating expected future values are risk-neutral probabilities.
7. **Juan Pablo Garrido Lagos, Stephen X. Zhang (2011)[13]** in their paper studied about the two sets of the exercising rules to value multiple real options mainly in the mining projects. The first set of rules try to compare and then choose the largest NPV for each path of uncertainty which was simulated, and the second set uses a kind of polynomial regression method. The two sets of rules exercised are applied to a promising copper mine which have an option to expand and also an option to abandon. The model aims at capturing the option values associated with the mining flexibilities. The flexibility which is considered here is fully limited to multiple investment alternatives during a single instant of time. Also we

found that real options are more useful and important in less promising projects. The Sensitivity analysis was also done considering variation in price volatility and capex.

8. **Michael Boehlje; Cole Ehmke; (2005)[1]** in their paper mainly deals with the capital investment analysis and project assessment using the traditional budgeting methods. The concepts of economic profitability and time value of money are discussed in detail. Then the step by step approach for the NPV method is shown using 6 steps and each step is dealt with in detail describing all the important concepts used in them. Then the procedure for economic profitability is shown using an example to buy a tow truck with 6 steps as above. After this the financial feasibility calculation is done using the same example as mentioned for the economic profitability. Using charts for different rate of returns it mentioned the time value of money too.
9. **Pamela Peterson Drake (2007)[6]** discussed the risk involved in the capital budgeting using the statistical tools. She describes the risk involved in the cash flow predictions and the other type of project risks. She used range, standard deviation and coefficient of variability for the statistical measure of the cash flow risk. Other tools that were applied to evaluate total risk are sensitivity or scenario analysis and the simulation analysis. The simulation analysis was demonstrated using an example. Then the measurement of a project's market risk and leverage was done by using the beta values and pure play. Then the risk was incorporated in capital budgeting decisions using risk adjusted rate, return required for a project's market risk and adjustments in the company's cost of capital. Finally the assessment of project risk was performed using WACC and other tools.
10. **R. Heuberger, (2005)[11]** in his paper discussed about the South Africa's Mining industry addressing the questions like risk analysis, Monte Carlo simulation etc. Various kinds of computer models are created for this purpose. He illustrates using a practical example of the mining industry, how risk analysis techniques be used in supporting investment decisions within the climate of uncertainty. Risk analysis gives the decision makers various idea about range of possible outcomes together with a accuarate probability estimate of the likelihood of results different from the average occurring. The simulation feature of risk analysis allows mine planners to test and validate better operational forecasts.
11. **Ronald Chifamba (2003)[2]** in his papers investigate the issues related to investment with main focus on the mining sector in Zimbabwe. The issues which are analyzed have risk

levels attracting investment in minerals of the developing countries. It's concerned with the firms in the sector whether they manage to reduce operation to optimal levels as consistent with the theoretical predictions and the extent to which irreversibility caused the reduced investment expenditures. In his paper he mentioned the scenario of mining industry, risk involved using adjusted Hotelling model, mineral cost analysis, irreversibility effects on mining investment etc.

12. **Ross R. Bhappu; Jaime Guzman (1995)[14]** in his paper dealt with the capital budgeting methods and foreign risk assessment while making mining investment decisions. A survey of 20 mining companies was done reporting average cost of capital, annual amount of capital budgeted and the minimum rate of return for mining companies. The survey depicted how the companies treated foreign projects and how much their economic valuation changed with their geographical location. The major tools used were a combination of IRR, Payback period and NPV. Large premiums charged on precious metals have been the trend for years and the current premium on properties of base metals appear to be common. We can only assume that in future the mining project transactions premiums will be attached with that of the discounted cash flow valuation.
13. **Roussos G. Dimitrakopoulos, Sabry A. Abdel Sabour (2007)[5]** work deals with the implementation of ROV in dealing with the complex mining projects along with finding out whether it can be applied for making decisions to improve project value. At first, this paper introduce a simulation-based ROV method for handling the multiple uncertainties as well as the variation in cash flow parameters which characterize mining projects. Then the paper gives an example to investigate about the impact ROV may have on the project profitability, by enhancing the decision making process. Then a case study for selecting the most profitable design and production sequence in an Australian gold mine with multiple sources of uncertainty is presented. Both the traditional NPV method and the proposed real options method are applied for evaluating the various technically feasible mine plans with fixed schedules so as to select the most economically suitable one.
14. **Silva Da Pedro Bueno; Brian Gillespie; Fabio Bueckeridge; (2012)[3]** of PWC Company dealt with the investment appraisal used in the mining capital projects. Sovereign risk metrics are common input to financial models alongside currency hedges and infrastructure costs. This allows to compare one potential project in one country to another using a

number of qualitative assessments. Top tier mining companies like BHP and Rio Tinto have a structured approach to ensure rigorous evaluation with investment decisions. Financial feasibility of projects using NPV, IRR, capital efficiency ratio, margin curve percentile, cost curve percentile, future option value, benchmarking and a metric representing some of the internal measure for a strategic fit is studied.

15. **S Shafiee, E Topal and M Nehring (2009)[15]** discussed about the adjusted real option valuation for maximizing a mine project value. In this paper the first section reviews a detailed study of ROV in mining projects. The paper then tries to introduce a new model for solving the problem where our potential method lacked. This new method try to find the maximum mining project value by adding total cost as a function of the production rate with that to the ROV. The second section deals with a new model in the Century Zinc mine of the North-West Queensland. The new version of the mine helped in giving a significant positive value to the mine. So the new method give option to add value to mining projects, maximizing project's value, estimating cost function, optimizing production rates and give opportunities in projects to increase gains and mitigate losses.
16. **Sudip Das (2010)[4]** in his paper analyzed the liquidity position, solvency status, financial viability and profitability of 5 coal and non-coal Indian companies using the financial ratios. From the financial statements the financial ratios of past 3 years of the companies are found. A detailed layout of all the important terms and concepts related to financial statements were provided. Programs in C++ were developed to calculate the financial ratios from the financial statements. Tally 9.0 package was used for the analysis and calculations. The companies that were taken are ACC, Hindustan Zinc, Tata Steel, GMDC & Jindal Steel & Power Limited.

CHAPTER 3

THEORY

3.1 Investment evaluation of Mining (Engineering) Projects

A project is an important activity where we expand our capital resources to create a producing asset from which we can expect to realize benefits over an extended period of time. Project is an activity on which we will spend money in expectation of returns and which logically seems to lead itself to planning, financing and implementation as a unit.

A project should have the following characteristics:

- It should have a specific starting point and a specific ending point.
- Its major costs and returns are measurable.
- It should have a well-defined time sequence of investment and production activities.

One company will have different projects. Because of economic dependency, a need arises for comparing projects to accept one and reject others. This process is known as the evaluation of engineering alternatives or projects.

3.1.1 Investment Evaluation Criteria

Three steps are involved in the evaluation of an investment:

- Estimation of cash flows.
- Estimation of the required rate of return (the opportunity cost of capital)
- Application of decision rule for making the choice

3.1.2 Investment Decision Rule

The investment decision rules may be referred to as capital budgeting techniques, or investment criteria. A sound appraisal techniques should be used to measure the economic worth of an investment project. The criteria for evaluation are:

a. It should consider all the cash flows to determine the true profitability of the project.
b. It should provide for an objective and unambiguous way of separating good projects from bad projects.
c. It should help running of projects according to their true profitability.
d. It should recognize the fact that bigger cash flows are preferable to smaller ones and early cash flows are preferable to the later ones.

e. It should help to choose among mutually excessive projects that project which maximizes the shareholder's wealth.

f. It should have a criterion which applies to any conceivable investment projects independent of others.

3.1.3 Types of Investment Decisions

I. Expansion and Diversification: A company may add capacity to its existing product lines to expand existing operations. It is called as related diversification. A firm may expand its activities in a new business. Expansion of a new business requires investment in new products and a new kind of production activity within the firm. This process is called unrelated diversification. Sometimes a company acquires existing firms to expand its business. It is called as the revenue- expansion investments.

II. Replacement and Modernization: The main objective of modernization and replacement is to improve operating efficiency and reduce costs. Assets become outdated and obsolete with technological changes. The firm must decide to replace those assets with new assets that operate more economically. Replacement decisions help to introduce more efficient and economic assets and therefor are also called cost reduction investments.

3.1.4 Importance of Investment Decisions

- They influence the firm's growth in the long run.
- They effect the risk of the firm.
- They involve commitment of large amount of funds.
- They are irreversible or reversible at substantial loss.
- They are among the most difficult back bone decisions to make.

3.2 The Cost Concept and its Classification

- Real Cost: The term "real cost of production" refers to the physical quantities of various factors which are used in producing a commodity. Real cost depicts the aggregate of all real productive resources for the production of a commodity. The real cost of production of a commodity refers to the exertion of labor, supply capital and social effects of pollution, congestion and environmental decisions.
- Opportunity Cost: It refers to the cost of foregoing or the cost of giving up an opportunity. It is the cost of the next best alternative. It implies the income of benefit foregone because

a certain course of action has been taken. It plays an important role in decision making and useful in determination of relative prices of different goods. It is also useful in fixing the price of an output factor. Above all, it helps in the best allocation of available resources.

- Money Cost: It is the total money expenses incurred by a business firm on the various items which enters the production of a product. For example, money payments made on wages, salaries to worker and managerial staff, payment for raw materials purchased, expenses on power and light, insurance, transportation, advertisement and also payments made on the purchase of machinery and equipment etc. constitute the money cost of production.
- Explicit & Implicit Cost: Explicit cost refer to the actual money outlay or out of pocket expenditure of the firm to buy or hire the production resources it needs in the process of production. It is referred to as out of pocket cost. Implicit costs are those which are not paid in cash to anyone. They are not actually incurred, but are computed for decision making purposes. These are also known as imputed costs or hypothetical costs.
- Accounting Cost: It represents all such expenditure which are incurred by a firm on factors of production. Thus accounting costs are explicit costs. In short, all items of expenses appearing on the debt side of trading, profit and loss account of a firm represent the accounting cost.
- Economic Cost: It is the total of explicit and implicit cost. It includes the payment for factors of production (rent, wages) and the payments for the self-owned factors (interest on owned capital. Rent on owned premises, salary to entrepreneurs etc.).
- Social Cost of Production: Cost incurred by the society in terms of resources used in the production of a commodity is known as social cost of production. It is the opportunity cost borne by a whole society or community. Social costs include only the cost borne by the owner of a business but also the cost passed on to the society.
- Fixed & Variable Cost: Fixed costs are those which don't vary with the volume of production. These costs remain fixed to a certain level of production ex rent, interest, depreciation, insurance, salaries etc. They are also called supplementary costs. Average fixed cost changes with a change in the quantity of production. If the volume of production increases, average fixed cost will decrease. Thus there is an inverse relationship between fixed costs and quality of production.

Variable costs are those costs which change with the quantity of production. When the output increases, variable cost also increases and vice versa. Thus there is a direct relationship between variable cost and volume of production. Variable costs are also known as prime costs or direct costs. Examples are materials, wages, power stores etc. Variable cost consist of direct material cost, direct labor cost and other direct expenses.

3.3 Time Value of Money

The value of money at a particular time is called the time value of money. Here value of money refers to purchasing power as well as earning power of money. Money tomorrow is not as valuable as money today. There are three basics reasons to support the Time Value of Money concept.

- A rupee can be invested and earn interest over time, giving it potential earning power.
- Money is subject to inflation, eating away at the spending power of the currency over time, making it worth less in future.
- Finally there is always the risk of not actually receiving the rupee in the future.

Future cash flows must be discounted to be compared with the cash flows in the present. Almost all economic decisions in mining involves cash flows occurring at different points of time. For simple calculation, FV are calculated by taking current values and multiplying by the compound interest rate. Equivalent future values (anticipated cash flows) are turned into the equivalent present value by discounting.

3.3.1 Future Value & Present Value of Investments

The value of money fluctuates over time. So to evaluate the actual worthiness of an amount of money today after a given period of time, economic agents compound the amount of money at a given (interest) rate.

The two functions used to relate present values to future values and vice versa are:

- The compound amount function (Future Value)
- The present value function

Future value is determined by the following formula

$$FV = PV \times (1 + i)^n$$

Where

FV = the future value

PV = the present value

i = the interest rate (for the given time period)

n = the number of time periods (years)

$(1+i)^n$ = the compound factor

3.3.2 Annuities

An annuity is a sequence of fixed equal payments or receipts made over a periodic interval. Some common examples are weekly wages, monthly salary, insurance premium etc. Loans are normally repaid with an annuity and investment funds are setup to meet fixed future commitments by the payment.

Types of Annuities: Immediate annuities, deferred annuities, normal annuities

3.4 Capital Budgeting Decisions and techniques

The investment decisions taken in a firm are generally known as the capital budgeting or the capital expenditure decisions. A capital budgeting decision may be defined as the firm's decision to invest its current funds most effectively in the long term assets in anticipation of an expected flow of benefits over a series of years. The long term assets are those that effect the firm's operation beyond the one year period.

The firm's investment decisions would generally include expansion, acquisition, modernization and replacement of long term assets. Capital budgeting decisions are important to a firm since they tend to determine the value by influencing its growth, profitability and risk. It is important to note that investments in long term assets invariably requires large funds to be tied up to the current assets such as inventories and receivables. As such investment in fixed and current assets is one single activity.

3.4.1 Capital Budgeting Techniques

I. Discounted Cash Flow (DCF) Criteria
   - Net Present Value (NPV) method
   - Internal Rate of Return (IRR) method
   - Profitability Index (PI) method

II. Non- discounted Cash Flow Criteria
   - Payback (PB) period method
   - Future Worth method
   - Accounting Rate of Return (ARR) method
   - Real Option method

3.4.2 Net Present Value (NPV) Method

The Net present value (NPV) method is the classic economic method of evaluating the investment proposals. It is a DCF technique that explicitly recognizes the time value of money. It correctly postulates the cash flows arising at different time periods differ in value and are comparable only when their equivalents present values are found out.

The following steps are involved in calculating NPV of a project:

1. Cash flows of the project should be forecasted based on realistic assumption.
2. Second step is to determine appropriate rate of interest that should be selected as the minimum rate of return called cut off rate or discount rate.
3. Present value of cash flows should be calculated by using the discount rate. Both the cash inflows and outflows should be converted into present worth.
4. Calculate the net present value of each project by subtracting the present value of cash outflows of each projects.
5. Follow the Acceptance Rule:

- Accept the project when NPV is positive (NPV > 0)
- Reject the project when NPV is negative (NPV < 0)
- May accept the project when NPV is zero (NPV = 0)

6. To select between mutually exclusive projects, projects should be ranked in order of net present values, i.e. the first preferences should be given to project having maximum positive net present value.

The equation for the Net Present Value can be written as:

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+k)^t} - C_0$$

Where

C_t = Net Cash flow in t^{th} year

C_0 = Initial Investment Cost

k = discount rate

n = the number of time periods

Advantages

1. It recognize the time value of money and it's suitable to be applied in a situation with uniform cash outflows and uneven cash inflows at different period of time.

2. It takes into account the earnings over the entire life of the project and the time profitability of the investment proposal can be revaluated.
3. It also takes into consideration the objective of maximum profitability.

Disadvantages

1. As compared to other traditional methods, it is difficult to understand and operate.
2. It mayn't give good results while comparing projects with unequal lives as the project having higher net present value but realized in a longer life span mayn't be desirable as a project having something lesser net present value achieved in a much shorting span of life.
3. In the same way as above, it mayn't give good results while comparing projects with unequal and appropriate discount rate.
4. It is not easy to determine an appropriate discount rate.

3.4.3 Internal Rate of Return Method

The internal rate of return (IRR) method is another discounted cash flow technique, which takes account of the magnitude and timing of cash flows. Other terms used to describe the IRR method are yield on an investment, marginal efficiency of capital, rate of return over cost, time adjusted rate of internal return and so on. Unlike the NVP method under the internal rate of return method, the cash flows of a project are discounted at a suitable rate by limit and trial method, which equals to the net present value to be zero. Since the discount rate is determined internally this method is called as the internal rate of return method.

The equation giving the IRR value is:

$$\sum_{t=1}^{n} \frac{C_t}{(1+IRR)^t} - C_0 = 0$$

Where

C_t = Net Cash flow in t^{th} year

C_0 = Initial Investment Cost

IRR = internal rate of return

MARR: Minimum Acceptable Rate of Return (MARR) is the rate set by an investment organization to designate the lowest level of return that makes an investment acceptable. It is the lowest level of return at which an independent engineering alternative is still attractive. It is generally agreed that the MARR should be no lower and most likely considerably higher than the

cost of capital. The purpose of setting of a MARR is to allocate capital to the most deserving projects.

Acceptance Rule:

- Accept the project if the IRR is greater than opportunity cost of capital (IRR> k)
- Reject the project when IRR is less than cost of capital (IRR< k)
- May remain indifferent when IRR = k

Advantages

1. Like NPV method it takes into account the time value of money and can be usefully applied in situations, with even as well as uneven cash flow at different periods of time.
2. It considers the profitability of the project for its entire economic life and hence enables evaluation of true profitability.
3. The determination of cost of capital is not a prerequisite for its use and hence it is better than NPV method where the cost of capital can't be determined easily.
4. It provides uniform ranking of various proposals due to percentage rate of return.
5. This method is also compatible with the objective of maximum profitability and is concerned to be more reliable technique of capital budgeting.

Disadvantages

1. It is difficult to understand & most difficult method of evaluation of investment proposals.
2. It shouldn't be used to rate mutually exclusive projects, but only to decide whether a single project is worth investing in.
3. IRR overstates the annual equivalent rate of return for a project whose interim cash flows are reinvested at a rate lower than the calculated IRR.
4. IRR doesn't consider cost of capital, it shouldn't be used to compare projects of different duration.
5. In case of positive then negative and then positive cash flow, IRR has many values.

3.4.4 Profitability Index Method

It is another time adjusted method of evaluating the investment proposals called the benefit- cost (B/C) ratio or profitability index (PI). PI is the ratio of the present value of cash flows at the required rate of return to the initial cash outflow of the investment.

The formula for calculating benefit- cost ratio or PI is as follows:

$$PI = \frac{PV\ of\ cash\ inflows}{Initial\ cash\ outlay} = \frac{\sum_{t=1}^{n} \frac{C_t}{(1+k)^t}}{C_0}$$

Where

C_t = Net Cash flow in t^{th} year

C_0 = Initial Investment Cost

k = discount rate

n = the number of time periods

Acceptance Rule

- Accept the project if PI > 1.
- Reject the project if PI< 1.
- May accept the project if PI = 1.

3.4.5 Payback Period Method

The payback as well as discounted payback period methods are most popular and widely recognized traditional method of evaluating investment proposals. Payback is the number of years required to recover the original cash outlay invested in a project. If the project generates constant annual cash inflows, the payback period can be computed by dividing cash outlay by the annual cash inflow. i.e.

$$Payback = \frac{Initial\ Investment}{Annual\ Cash\ Flow}$$

In case of unequal cash inflows, the payback period can be found out by adding up the cash inflows until the total is equal to the initial cash outlay. But in the discounted payback period method the present values of all cash outflows and inflows are computed at an appropriate discounted rate. The present values of all inflows are calculated in order of time. The time period at which the cumulated present value of cash inflows equals the present value of cash outflows is known as discounted payback period.

Acceptance Rule

- Accept when the project's payback period < standard payback period set by management.
- Reject when the project's payback period > standard payback period set by management.
- May accept the project if both the payback periods are equal.

Advantages

1. The discounted payback period is more reliable than simple payback since it accounts for time value of money.
2. Its simplicity. Using the PB method we reduce the evaluation to simple number of years which is an easily understood concept.
3. It can easily identify projects which provide the fastest return on investment and is handy for companies requiring quick recovery.

Disadvantages

1. It ignores the cash inflows from projects after the payback period.
2. Since the discounted PB method focuses on short-term profitability, an attractive project could be overlooked if the PB period is the only consideration.
3. It doesn't account for risk financing and other important consideration such as opportunity cost.

3.4.6 Future worth Method

It is evident that a present worth can be translated to a future worth at any given time at a given discounted rate. The process of conversion to present is elementary, but the change in perspective of the analysis can be significant. For certain situation, the future worth of cash flow may be more meaningful to a decision maker than the present worth. The amount of debt or surplus accumulated at a future date could be a milestone in a financial plant that directs current activities.

The future worth can be calculated by:

$$FW = PW \times (1 + i)^n$$

Always the project with higher FW should be selected.

3.4.7 Accounting Rate of Return Method

The accounting rate of return (ARR) also known as the return on investment (ROI) uses accounting information as revealed by financial statements, to measure the profitability of an investment. The accounting rate of return is the ratio of the average after tax profit divided by the average investment. The average investment would be equal to half of the original investment if it were depreciated constantly. Alternatively it can be found out by dividing the total of the investment's book values after depreciation by the life of the project.

The ARR is an average rate and can be determined by the following equation:

$$ARR = \frac{Average\ Income}{Average\ investment}$$

Average income should be defined in terms of earnings after taxes without an adjustment for interest viz. EBIT(1-T) on net operating profit after tax

$$ARR = \frac{[\sum_{t=1}^{n} EBIT_t(1-T)]/n}{(I_0 + I_n)/2}$$

Where

EBIT = earnings before interest and taxes

T = tax rate

I_0 = Book value of investment in the beginning

I_n = Book value of investment at the end of n number of years

Acceptance Rule

- Accept the project if ARR> minimum rate established by management
- Reject the project if ARR< minimum rate established by management

This method would rank a project as number one if it has highest ARR and lowest rank to the project with the lowest ARR.

Advantages

1. ARR is based on accounting information therefore other special reports are not required for determining ARR.
2. ARR method is easy to calculate and simple to understand.
3. It is based on accounting profit hence measures the profitability of investment.
4. Another advantage is familiarity. The ARR concept is a familiar concept to return on investment (ROI) or return on capital employed.

Disadvantages

1. This technique is based on profit rather than cash flow. Therefore it can be affected by non-cash items such as depreciation and bad debts when calculating profits. The change of methods for depreciation can be manipulated and lead to higher profits.
2. This technique doesn't adjust for the risk to longer term forecast.
3. ARR doesn't take into account the time value of money.
4. This technique can be calculated in a wide variety of ways and hence lead to different outcomes.

3.4.8 Real Option Method

Real option is a systematic approach and integrated solution using financial theory, economic analysis, management science, decision sciences, statistics and econometric modelling in applying options theory in valuing real physical assets as opposed to financial assets, in a dynamic and uncertain environment where business decisions are flexible in the context of strategic capital investment decision making, valuing investment opportunities and project capital expenditures.

Working Areas of Real Option

- Timing- Flexibility to change the start date of a project.
- Sizing- Ability to increase or decrease size of a project.
- Flexibility- Ability to alter operations and changing prices.
- Fundamental- Deciding on the capital budget and initiation of new projects.

Procedures for Valuing Real Options

a. Discounted cash flows analysis of expected cash flows, ignoring the option.
b. Qualitative assessment of the real option's value.
c. Decision tree analysis.
d. Standard model for a corresponding financial option.
e. Financial engineering techniques.

Advantages

1. The real option approach considers multiple decision pathways as a consequence of high uncertainty coupled with management's flexibility in choosing the optimal strategies or options along the way when new information becomes available.
2. It is a dynamic decision making process which gives the flexibility to make midcourse strategy corrections when there is uncertainty involved in future.
3. It is really helpful while considering for long term investment decisions.

Disadvantages

1. The decision process involved can quickly become quite complex. When we try to incorporate more factors into the capital budgeting valuation framework, the more "noise" is introduced giving rise to less accurate analysis results.
2. The array of probability estimates used for each option used can lead to the largest source of uncertainty.
3. It is impractical to consider all the embedded real options of a project simultaneously.

3.5 Financial Ratio Analysis

Financial ratios are mathematical comparisons of financial statements, accounts or categories. The relationships between the financial statements help investors, creditors and internal company management understand how well a business is performing and area of needing improvement. Financial statements are the formal records of all the financial activities of a person or organization. There are mainly 4 types of financial statements:

- The income statement
- The balance sheet
- Profit- Loss statement or the statement of Retained earnings.
- The Cash flow statement

3.5.1 Terms related to the Financial Ratio Analysis

In financial analysis we study the financial statements of a company to have an overview of its current and future financial health. For the financial ratio analysis of the 20 ratios taken in the paper we need to understand the following terms used in financial statements:

1. Equity: Total amount of financing provided by the owners of the business and operations.
2. Reserves: An accounting entry that properly reflects the contingent finance.
3. Net Worth/ Shareholder's fund: It is the sum of Share capital or equity and the reserves of the company.
4. Long term debt: Taxes, leases, loans etc. which are payable over a period greater than one year.
5. Current Liabilities: Amount owed for slaries, interest, accounts payable and other debts due within 1 year.
6. Total Liabilities: Sum total of all current and non-current liabilities.
7. Capital Work in Progress: Amount used during a particular period to acquire or improve long term assets such as property, plant or equipment.
8. Investment: Money or capital that is invested in a business in order to make a profit or earn interest. It is the sum of Current and Non-Current Investment
9. Inventories: Raw materials, items available for sale or in the process of being made ready for sale.
10. Receivables: Shown as a part of current assets, money which is owed to a company by customers who have purchased goods or services in credit.

11. Cash & Cash Equivalent: The amount of cash in bank accounts along with the value of assets that can be converted into cash immediately. It includes bank accounts, marketable securities and Banker's Acceptances.
12. Current Assets: It's the liquid assets comprising of cash, account receivables, inventories, marketable securities and other assets that could be converted to cash in less than 1 year.
13. Fixed Assets: It is a part of the non-current assets and can't be easily transformed into cash. It consists mainly of Property, plant and equipment.
14. Total Assets: It is the sum of all Current and Non-current assets.
15. Capital Employed: It is obtained by subtracting Current liabilities from the Total assets.
16. Net Sales/Operations: It is the revenue generated from the sales made by company.
17. Total Revenue: A total measure of the inflow or increase in net assets generated by the sales made by a company and other incomes. It is a reflection of the amount brought into the company by the sales process during a specified period of time.
18. Cost of Goods Sold: It represents the expense related to labor, raw materials and manufacturing overhead involved in the manufacturing process.
19. Total Expense: The total expenditure incurred by the enterprise to earn revenue by including all type of costs is called total expense.
20. Gross Profit: It is obtained by subtracting cost of goods sold from the Net Sales.
21. Operating Profit: It is obtained by subtracting selling, general and administrative (SG&A) expenses from the Gross Profit.
22. EBDIT: It is the earnings or profit before depreciation, interest and taxes.
23. Net Profit: It is the actual profit made by the company after subtracting the depreciation, interest, exceptional and extraordinary items and taxes.

3.5.2 Financial ratios used in the Project

Ratios are useful for a raw computation of financial position and performances. The can also be used to analyze trends and to compare a firm's financial figures to those of competitors or those in the business sector to which the company belong. It is highly helpful for the management in decision making. Financial ratios are often divided into 6 main categories: liquidity; solvency/debt; efficiency; profitability; market prospect & investment, leverage, coverage. The ratios considered in the project are categorized in 4 groups.

I. Liquidity Measurement Ratio

Liquidity ratio mainly attempt to measure a company's ability to pay off its short term debt obligations. This is done by comparing a company's most liquid assets and liabilities.

1. Net Working Capital: It is the aggregate amount of all current assets and current liabilities. It is used to measure the short-term liquidity of a business, and can also be used to obtain a general impression of the ability of company management to utilize assets in an efficient manner. To calculate net working capital, the following formula is used:

$$Net\ Working\ Capital = Current\ Assets - Current\ Liabilities$$

2. Current Ratio: It is used to test a company's liquidity by deriving the proportion of current assets available to cover current liabilities. It ascertains whether a company's short term assets are readily available to pay off its short term liabilities. Ratio of 2:1 is acceptable

$$Current\ ratio = \frac{Current\ Assets}{Current\ Liabilities}$$

3. Quick/Acid test Ratio: It measures the ability of a company to pay its current liabilities when they come due with only the quick assets. Quick assets are current assets which can be converted to cash within 90 days. Ratio of 1:1 is acceptable.

$$Quick\ ratio = \frac{Quick\ Assets}{Current\ liabilities} = \frac{Current\ Assets - Inventories}{Current\ liabilities}$$

4. Cash Ratio: It measures a firm's ability to pay off its current liabilities with only cash and cash equivalents. It shows whether a company maintains adequate cash balances to pay off all of their current debts as they come due. Ratio of 0.5: 1 is acceptable.

$$Cash\ ratio = \frac{Cash + Marketable\ Securities}{Current\ Liabilities}$$

II. Profitability Indication Ratio

It discusses the different measures of corporate profitability and financial performance. They give a good understanding of how well the company used its resources to generate profit and revenue for Shareholder's.

5. Gross Profit Margin: It is the ratio of the gross profit and sales made by a company which is then expressed in percentage. The metric is an indication of the financial success and viability of a particular product or service. The higher the percentage, the more the company retains on each rupee of sales to service its other costs and obligations.

$$Gross\ Profit\ margin = \frac{Gross\ Profit}{Sales} \times 100$$

6. Operating Profit Margin: It is the ratio of operating profit and sales given in percentage. It shows how much profit before taxes and interest is generated in comparison to the sales made. Higher the margin better is the company's situation in profitability.

$$Operating\ Profit\ margin = \frac{Operating\ Profit}{Sales} \times 100$$

7. Net Profit Margin: It is the ratio of the net profit made by a company to its sales and given in percentage. It shows what percentage of revenue made it all the way to the bottom line, which is good for investors.

$$Net\ Profit\ margin = \frac{Net\ Profit}{Sales} \times 100$$

8. Return on Assets: It indicates how profitable a company is relative to its total assets. The ROA illustrates how well the management employs the company's assets to make a profit. Higher the ROA more efficient is the management.

$$Return\ on\ Assets = \frac{Operating\ Profit}{Average\ Assets} \times 100$$

9. Return on Investment: It measures the percentage return made on a particular investment. It is also used to indicate the profitability of a company using the various investments.

$$Return\ on\ Investment = \frac{Net\ Profit}{Net\ Investment} \times 100$$

10. Return on Equity: It indicates the profitability of a company by comparing its net income to the average shareholder's equity. The ROE measures how much the shareholder's earned for their investment in the company. Higher the percentage, more efficient is the management in utilizing the equity base.

$$Return\ on\ Equity = \frac{Net\ Profit}{Average\ Shareholder's\ fund} \times 100$$

11. Return on Capital Employed: As the capital employed deducts the current liabilities of a company from its total Shareholder's fund so ROCE indicates the company's ability to generate return from the available capital base which is the company's total pool of capital.

$$Return\ on\ Capital\ Employed = \frac{Operating\ Profit}{Average\ Capital\ Employed} \times 100$$

III. Debt/ Liabilities Ratio

These ratios give a general idea of the company's overall debt load as well as its mix of equity and debt. It is used to determine the level of financial risks faced by a company and its investors. The greater the amount of debt of a company, greater is the financial risk.

12. Debt Ratio: It compares the total debt or liabilities of a company to its total assets. It gives a general idea about the leverage being used by the company. A lower ratio shows the lower dependency of the company on leverage. It should lie between 0 and 1.

$$Debt\ ratio = \frac{Total\ Liabilities}{Total\ Assets}$$

13. Debt Equity Ratio: It compares the total liabilities of a company to its shareholder's equity. It shows how much suppliers and creditors have committed to the company in comparison to the shareholders. Lower the value stronger is the company's equity position.

$$Debt\ Equity\ ratio = \frac{Total\ Liabilities}{Shareholder's\ Equity}$$

14. Capitalization Ratio: It compares the total long term debt to the total capitalization of the company (capital structure). The capitalization ratio reflects the extent to which a company is operating on its equity. Companies with higher values are considered risky.

$$Capitalization\ ratio = \frac{Long\ term\ debt}{(Long\ term\ debt + Shareholder's\ Equity)}$$

15. Cash flow to Debt Ratio: It compares the cash flow on operation or the Operating profit to that of the total liabilities. It is an indicator of the ability of a company to pay interest and principal amounts when they become due. Ratio more than 1 is considered good.

$$Cash\ flow\ to\ Debt\ ratio = \frac{Operating\ Cashflow/\ Profit}{Total\ Liabilities}$$

IV. Operating Performance Ratio

These ratios have different inputs and measure different segments of a company's overall operational performance and management during the period being measured.

16. Receivables Turnover Ratio: It measures a firm's effectiveness in extending credits as well as collecting debts. It measures how many times a business can collect its average accounts receivable during the year. Higher the ratio better is the company management as the company is successful in collecting its outstanding credit balances.

$$Receivable\ Turnover\ ratio = \frac{Net\ Sales}{Receivables}$$

17. Fixed Asset Turnover Ratio: It measures a company's ability to generate net sales/ revenue from the investment made on fixed assets. A higher ratio shows the company is more capable to generate revenues from the assets.

$$Fixed\ Asset\ Turnover\ ratio = \frac{Revenue}{Fixed\ Assets}$$

18. Inventory Turnover Ratio: It shows how effectively inventory is managed by comparing cost of goods sold with average inventory for a period. This measures how many times average inventory is "turned" or sold during a period. Higher value is preferred.

$$Inventory\ Turnover\ ratio = \frac{Cost\ of\ Goods\ Sold}{Average\ Inventory}$$

19. Operating Ratio: It compares production and administrative expenses to net sales. The ratio reveals the cost per sales dollar of operating a business. A lower operating ratio is a good indicator of operational efficiency.

$$Operating\ ratio = \frac{Total\ Expense}{Sales}$$

20. Total Asset Turnover ratio: It an efficiency ratio that measures a company's ability to generate sales from its assets by comparing net sales with average total assets. Higher turnover ratios mean the company is using its assets more efficiently.

$$Total\ Asset\ Turnover\ ratio = \frac{Net\ Sales}{Average\ total\ Assets}$$

3.6 Risk Analysis

Risk analysis is part of every decision we make. We are constantly faced with uncertainty, ambiguity, and variability. And even though we have unprecedented access to information, we can't accurately predict the future. It helps us to develop insights, knowledge and confidence for better decision making and risk management.

3.6.1 Risk analysis approaches

a) Scenario analysis
b) Sensitivity analysis
c) Monte-Carlo simulation
d) Decision Analysis
e) Option theory

3.6.2 Monte Carlo Simulation

Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. The technique is used by professionals in such widely disparate fields as finance, project management, energy, manufacturing, engineering, research and development, insurance, oil & gas, transportation, and the environment. Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action. It shows the extreme possibilities -the outcomes of going for broke and for the most conservative decision -along with all possible consequences for middle-of-the-road decisions.

How Monte Carlo simulation works

Monte Carlo simulation performs risk analysis by building models of possible results by substituting a range of values—a probability distribution—for any factor that has inherent uncertainty. It then calculates results over and over, each time using a different set of random values from the probability functions. Depending upon the number of uncertainties and the ranges specified for them, a Monte Carlo simulation could involve thousands or tens of thousands of recalculations before it is complete. Monte Carlo simulation produces distributions of possible outcome values.

By using probability distributions, variables can have different probabilities of different outcomes occurring. Probability distributions are a much more realistic way of describing uncertainty in variables of a risk analysis. Common probability distributions include:

a. Normal – Or "bell curve." The user simply defines the mean or expected value and a standard deviation to describe the variation about the mean. Values in the middle near the mean are most likely to occur. It is symmetric and describes many natural phenomena such as people's heights. Examples of variables described by normal distributions include inflation rates and energy prices.
b. Lognormal – Values are positively skewed, not symmetric like a normal distribution. It is used to represent values that don't go below zero but have unlimited positive potential. Examples of variables described by lognormal distributions include real estate property values, stock prices, and oil reserves.

c. Uniform – All values have an equal chance of occurring, and the user simply defines the minimum and maximum. Examples of variables that could be uniformly distributed include manufacturing costs or future sales revenues for a new product.
d. Triangular – The user defines the minimum, most likely, and maximum values. Values around the most likely are more likely to occur. Variables that could be described by a triangular distribution include past sales history per unit of time and inventory levels.
e. PERT- The user defines the minimum, most likely, and maximum values, just like the triangular distribution. Values around the most likely are more likely to occur. However values between the most likely and extremes are more likely to occur than the triangular; that is, the extremes are not as emphasized. An example of the use of a PERT distribution is to describe the duration of a task in a project management model.
f. Discrete – The user defines specific values that may occur and the likelihood of each. An example might be the results of a lawsuit: 20% chance of positive verdict, 30% change of negative verdict, 40% chance of settlement, and 10% chance of mistrial.

Advantages of Monte Carlo Simulation

1. Probabilistic Results. Results show not only what could happen, but how likely each outcome is.
2. Graphical Results. Because of the data a Monte Carlo simulation generates, it's easy to create graphs of different outcomes and their chances of occurrence. This is important for communicating findings to other stakeholders.
3. Sensitivity Analysis. With just a few cases, deterministic analysis makes it difficult to see which variables impact the outcome the most. In Monte Carlo simulation, it's easy to see which inputs had the biggest effect on bottom-line results.
4. Scenario Analysis: In deterministic models, it's very difficult to model different combinations of values for different inputs to see the effects of truly different scenarios. Using Monte Carlo simulation, analysts can see exactly which inputs had which values together when certain outcomes occurred. This is invaluable for pursuing further analysis.
5. Correlation of Inputs. In Monte Carlo simulation, it's possible to model interdependent relationships between input variables. It's important for accuracy to represent how, in reality, when some factors goes up, others go up or down accordingly.

CHAPTER 4
FINANCIAL RATIO ANALYSIS OF IMPORTANT COAL MINING COMPANIES

4.1 Mahanadi Coalfield Limited: Mahanadi Coalfields Limited (MCL) is one of the major coal producing company of India. It is one of the eight subsidiaries of Coal India Limited. Mahanadi Coalfields Limited was carved out of South Eastern Coalfields Limited in 1992 with its headquarters at Sambalpur. It has its coal mines spread across Odisha. It has total seven open cast mines and three underground mines under its fold. MCL has two subsidiaries with private companies as a joint venture, MJSJ Coal Ltd & MNH Shakti Ltd.

Serial No	Entities (In crores)	As at March 31st, 2014	As at March 31st, 2013
1	Equity Share Capital	186.40	186.40
2	Reserves	5377.02	8752.72
3	Net worth/Shareholder's fund	5563.42	8939.12
4	Long term debt	375.55	380.93
5	Receivables	298.39	430.91
6	Current Liabilities	3245.64	4102.83
7	Total Liabilities	13944.31	13387.20
8	Capital work in progress	330.94	295.30
9	Investment	1773.78	1179.49
10	Inventories	522.52	571.53
11	Cash & Cash equivalent	10367.57	13083.00
12	Current Assets	14705.10	18098.54
13	Fixed Assets	3329.01	2726.07
14	Total Assets	19507.73	22326.07
15	Capital Employed	16262.09	18223.49
16	Net Sales	13165.61	13190.42
17	Total Revenue	12033.00	12093.21
18	Cost of Goods sold	547.03	555.75
19	Total Expense	6602.10	5898.13
20	Gross Profit	12539.26	12634.67
21	Operating profit/ Cash flow from operations	3722.65	4419.70
22	EBDIT	5429.08	6202.48
23	Net Profit	3624.30	4212.44

Table 4.1: Important data from the financial statements of Mahanadi Coalfield Limited

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	(14705.10 - 3245.64)= 11459.46	(18098.54- 4102.83) = 13995.71
2	Current Ratio	(14705.10 / 3245.64)= 4.53	(18098.54 / 4102.83) = 4.41
3	Quick/Acid test Ratio	(14705.10- 522.52)/ 3245.64 = 4.37	(18098.54- 571.53)/ 4102.83 =4.27
4	Cash Ratio	(10367.57/ 3245.64) = 3.19	(13083.00/ 4102.83)= 3.19
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(12539.26/ 13165.61)* 100 = 95.24	(12634.67/ 13190.42)* 100= 95.78
6	Operating Profit Margin (In %)	(3722.65/ 13165.61)*100 = 28.27	(4419.70/ 13190.42)* 100 = 33.50
7	Net Profit Margin (In %)	(3624.30/ 13165.61)* 100 = 27.52	(4212.44/ 13190.42)* 100 = 31.93
8	Return on Assets (In %)	(3722.65/ 19507.73)* 100 = 19.08	(4419.70/ 22326.32)* 100 = 19.79
9	Return on Investment (In %)	(3624.30/ 1773.78)* 100 = 204.32	(4212.44/ 1179.49)* 100 = 357.14
10	Return on Equity (In %)	(3624.30/ 5563.42)* 100 = 65.14	(4212.44/ 8939.12)* 100 = 47.12
11	Return on Capital Employed (In %)	(3722.65/ 16262.09)* 100 = 22.89	(4419.70/ 18223.49)* 100 = 24.25
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	(13944.31/ 19507.73) = 0.71	(13387.2/ 22326.32) = 0.60
13	Debt Equity Ratio	(13944.31/ 5563.42) = 2.51	(13387.2/ 8939.12) = 1.49
14	Capitalization ratio	375.55/ (375.55+ 5563.42) = 0.06	380.93/ (380.93+ 8939.12) = 0.04
15	Cash flow to Debt Ratio	(3722.65/ 13944.31) = 0.26	(4419.70/ 13387.20) = 0.33
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	13165.61/ 298.39 = 44.12	13190.42/ 430.91 = 30.61
17	Fixed Asset Turnover Ratio	(13165.61/ 3329.01) = 3.95	(13190.42/ 2726.07) = 4.83
18	Inventory Turnover Ratio	(626.35/ 547.03) = 1.14	(555.75/ 547.03) = 1.02
19	Operating Ratio	(6602.10/ 13165.61) = 0.50	(5898.13/ 13190.42) = 0.42
20	Total asset Turnover Ratio	(13165.61/ 19507.73) = 0.67	(13190.42/ 22326.32) = 0.59

Table 4.2: Calculation of the financial ratios for Mahanadi Coalfield Limited

4.2 Neyveli Lignite Corporation (NLC)

Neyveli Lignite Corporation is a government-owned lignite mining and power generating company in India. NLC operates the largest open-pit lignite mines in India, presently mining 24 MT of lignite and has an installed capacity of 2,740 MW of electricity. It also supplies a large quantity of sweet water to Chennai from the artesian aquifers in the lignite mines. On 11 April 2011, it joined the elite group of Navratna Companies. NLC has well-developed township in Neyveli in the district of Cuddalore, Tamil Nadu, India. NLC is currently in the news due to its disinvestment plans and the indefinite strike by its 27000 employees and workers.

Serial No	**Entities (In crores)**	**As at March 31st, 2014**	**As at March 31st, 2013**
1	Equity Share Capital	1677.71	1677.71
2	Reserves	12225.91	11273.62
3	Net worth/Shareholder's fund	13903.62	12951.33
4	Long term debt	2175.00	2600.00
5	Receivables	2204.45	3800.27
6	Current Liabilities	3243.59	2878.54
7	Total Liabilities	4451.24	4804.32
8	Capital work in progress	3700.83	3146.49
9	Investment	1616.89	1432.40
10	Inventories	681.69	683.72
11	Cash & Cash equivalent	4258.58	2866.64
12	Current Assets	4888.81	4863.69
13	Fixed Assets	10171.45	9781.85
14	Total Assets	16677.15	16077.94
15	Capital Employed	13433.56	13199.40
16	Net Sales	5967.23	5590.07
17	Total Revenue	6991.56	6406.54
18	Cost of Goods sold	2928.68	2568.54
19	Total Expense	4110.51	3617.64
20	Gross Profit	3038.55	3021.53
21	Operating profit/ Cash flow from operations	1929.26	2044.61
22	EBDIT	2881.05	2788.90
24	Net Profit	1501.88	1459.75

Table 4.3: Important data from the financial statements of Neyveli Lignite Corporation

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	7144.72-3243.59 = 3901.13	7350.63- 2878.54 = 4472.09
2	Current Ratio	7144.72/3243.59 = 2.207	7350.63 / 2878.54 = 2.55
3	Quick/Acid test Ratio	(7144.72-681.69)/ 3243.59= 1.99	(7350.63- 683.72)/ 2878.54 = 2.31
4	Cash Ratio	4258.58/ 3243.59 = 1.31	2866.64/ 2878.54 = 0.99
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(3038.55/ 5967.23)* 100 = 50.92	(3021.53/ 5590.07)* 100 = 54.05
6	Operating Profit Margin (In %)	(1929.26/ 5967.23)* 100 = 32.33	(2044.61/ 5590.07)* 100 = 36.57
7	Net Profit Margin (In %)	(1501.88/ 5967.23)* 100 = 25.16	(1459.75/ 5590.07)* 100 = 26.11
8	Return on Assets (In %)	(1929.26/ 16677.15)* 100 = 11.56	(2044.61/ 16077.94)* 100 = 12.71
9	Return on Investment (In %)	(1501.88/ 1616.89)* 100 = 92.88	(1459.75/ 1432.40)* 100 = 101.90
10	Return on Equity (In %)	(1501.88/ 13903.62)* 100 = 10.80	(1459.75/ 12951.33)* 100 = 11.27
11	Return on Capital Employed (In %)	(1929.26/ 13433.56)* 100 = 14.36	(2044.61/ 13199.4)* 100 = 15.49
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	4451.24/ 16677.15 = 0.26	4804.32/ 16077.94 = 0.29
13	Debt Equity Ratio	4451.24/ 13903.62 = 0.32	4804.32/ 12951.33 = 0.37
14	Capitalization ratio	2157.0/ (2157.0 +13903.62) = 0.1352	2600.0/ (2600.0 + 12951.33) = 0.1671
15	Cash flow to Debt Ratio	1929.26/ 4451.24 = 0.43	2044.61/ 4804.32 = 0.42
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	5967.23/2204.45 = 2.70	5590.07/3800.27 = 1.47
17	Fixed Asset Turnover Ratio	6991.56/ 10171.45 = 0.68	6406.54/ 9781.85 = 0.65
18	Inventory Turnover Ratio	2928.68/ 681.69 = 4.29	2568.54/ 683.72 = 3.75
19	Operating Ratio	4110.51/ 5967.23 = 0.68	3617.64/ 5890.07 = 0.64
20	Total asset Turnover Ratio	5967.23/ 16677.15 = 0.36	5590.07/ 16077.94 = 0.34

Table 4.4: Calculation of the financial ratios for Neyveli Lignite Corporation

4.3 GUJARAT MINERAL DEVELOPMENT CORPORATION

Gujarat Mineral Development Corporation Limited (GMDC) is a major minerals and lignite mining company of India. It is State owned company owned by Government of Gujarat. GMDC was founded in 1963. Its corporate headquarters is at Ahmedabad. Its product range includes essential energy minerals like lignite, base metals and industrial minerals like bauxite and flourspar.Gujrat government as given its green signal to GMDC to form a joint venture with NALCO for a 1 mtpa refinery. GMDC also owns and runs Akrimota Thermal Power Station a 250 MW (2x125 MW) lignite based thermal power plant located in village Nanichher in Lakhpat Taluka, Kutch District.

Serial No	**Entities (In crores)**	**As at March 31st, 2014**	**As at March 31st, 2013**
1	Equity Share Capital	63.60	63.60
2	Reserves	2798.87	2471.35
3	Net worth/Shareholder's fund	2862.47	2534.95
4	Long term debt	169.15	175.91
5	Receivables	51.81	39.83
6	Current Liabilities	351.87	452.12
7	Total Liabilities	1082.49	1169.49
8	Capital work in progress	11.18	24.10
9	Investment	260.34	182.78
10	Inventories	47.15	39.27
11	Cash & Cash equivalent	41.83	56.84
12	Current Assets	1297.77	1185.61
13	Fixed Assets	1873.55	1804.33
14	Total Assets	3944.97	3704.45
15	Capital Employed	3593.10	3252.33
16	Net Sales	1289.66	1674.68
17	Total Revenue	1435.08	1830.16
18	Cost of Goods sold	233.11	222.41
19	Total Expense	805.49	906.09
20	Gross Profit	1056.55	1452.27
21	Operating profit/ Cash flow from operations	9484.17	768.59
22	EBDIT	629.59	924.06
23	Net Profit	439.13	600.84

Table 4.5: Important data from the financial statements of GMDC

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	1297.77 – 351.87 = 945.90	1185.61 – 452.16 = 733.49
2	Current Ratio	1297/ 351.87 = 3.68	1185.61/452.12 = 2.62
3	Quick/Acid test Ratio	(1297.77- 47.15)/ 351.87= 3.55	(1185.61 – 39.27)/ 452.12 = 2.53
4	Cash Ratio	41.83/351.87 = 0.12	56.84/ 452.12 = 0.13
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(1056.55/ 1289.66)* 100 = 81.92	(1452.27/ 1674.68)* 100 = 86.71
6	Operating Profit Margin (In %)	(484.17/ 1289.66)* 100= 37.54	(768.59/ 1674.68)* 100 = 45.89
7	Net Profit Margin (In %)	(439.13/ 1289.66) * 100 = 34.05	(600.64/ 1674.68)* 100 = 35.87
8	Return on Assets (In %)	(484.17/ 3944.97) * 100 = 12.27	(768.59/ 3704.45)* 100 = 20.74
9	Return on Investment (In %)	(439.13/ 260.34)* 100 = 168.67	(600.64/ 182.78)* 100 = 328.61
10	Return on Equity (In %)	(439.13/ 2862.47) * 100 = 15.34	(600.64/ 2534.98) * 100 = 23.69
11	Return on Capital Employed (In %)	(484.17/ 3593.10) * 100 = 13.47	(768.59/ 3252.33) * 100 = 23.63
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	1082.49/3944.97 = 0.27	1169.49/3704.45 = 0.31
13	Debt Equity Ratio	1082.49/ 2862.47 = 0.37	1169.49/ 2534.98 = 0.46
14	Capitalization ratio	169.15/ (169.15+ 2862.47) = 0.055	175.91/ (175.91+ 2534.98) = 0.064
15	Cash flow to Debt Ratio	484.17/1082.49 = 0.44	768.59/ 1169.49 = 0.65
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	1289.66/51.81 = 24.89	1674.68/ 39.83 = 42.04
17	Fixed Asset Turnover Ratio	1289.66/ 1873.55 = 0.68	1674.68/ 1804.33 = 0.92
18	Inventory Turnover Ratio	233.11/ 47.15 = 4.94	222.41/ 39.27 = 5.66
19	Operating Ratio	805.49/ 1289.66 = 0.62	906.09/ 1674.68 = 0.54
20	Total asset Turnover Ratio	1289.66/ 3944.97 = 0.32	1674.68/ 3704.45 = 0.45

Table 4.6: Calculation of the financial ratios for GMDC

4.4 RELIANCE POWER

Reliance Power Limited is part of the Reliance Anil Dhirubhai Ambani Group. It was established to develop, construct and operate power projects in the Indian and international markets. Reliance Energy Limited, an Indian private sector power utility company and the Anil Dhirubhai Ambani Group promote Reliance Power. With its subsidiaries, it is developing 13 medium and large-sized power projects with a combined planned installed capacity of 33,480 MW. Reliance Natural Resources merged with Reliance Power in 2010, shortly after its initial public offering. In July 2014, Reliance Power acquired the entire 1,800 MW hydropower portfolio of Jaiprakash Associates for over ₹10,000 crore.

Serial No	**Entities (In crores)**	**As at March 31st, 2014**	**As at March 31st, 2013**
1	Equity Share Capital	2796.63	2805.13
2	Reserves	14030.34	14020.06
3	Net worth/Shareholder's fund	16825.97	16825.19
4	Long term debt	211.35	0
5	Receivables	4.73	1.92
6	Current Liabilities	3680.02	1919.37
7	Total Liabilities	3910.02	1922.41
8	Capital work in progress		
9	Investment	16540.42	14662.18
10	Inventories		
11	Cash & Cash equivalent	549.13	556.82
12	Current Assets	2348.53	2206.37
13	Fixed Assets	408.41	84.49
14	Total Assets	20735.97	18747.60
15	Capital Employed	17055.95	16828.23
16	Net Sales	91.69	12.01
17	Total Revenue	366.12	250.85
18	Cost of Goods sold	94.46	47.63
19	Total Expense	304.98	144.72
20	Gross Profit	-2.77	-35.62
21	Operating profit/ Cash flow from operations	-117.67	-57.68
22	EBDIT	61.14	106.13
23	Net Profit	56.48	513.93

Table 4.7: Important data from the financial statements of Reliance Power

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	2348.53- 3680.02 = (-1331.49)	2206.37- 1919.37 = 287.00
2	Current Ratio	2348.53/ 3680.02 = 0.63	2206.37/1919.37 = 1.14
3	Quick/Acid test Ratio	2348.53/ 3680.02 = 0.63	2206.37/1919.37 = 1.14
4	Cash Ratio	549.13/ 3680.02 = 0.15	556.82/ 1919.37 = 0.29
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(2.77/ 91.69)* 100 = (-3.02)	(35.62/12.01) *100 = (-296.58)
6	Operating Profit Margin (In %)	(117.67/91.69)* 100 = (-128.33)	(57.68/12.01)* 100 = (-480.26)
7	Net Profit Margin (In %)	(56.48/ 91.69)* 100 = 61.59	(513.93/12.01)* 100 = 4279.18
8	Return on Assets (In %)	(117.67/20735.97) *100 = (-0.56)	(57.68/18747.60) * 100 = (-0.30)
9	Return on Investment (In %)	(56.48/ 16540.42) * 100 = 0.34	(513.93/14662.18) * 100 = 3.5
10	Return on Equity (In %)	(56.48/ 16825.97)* 100 = 0.33	(513.93/14662.18) * 100 = 3.05
11	Return on Capital Employed (In %)	(117.67/17055.95) *100 = (-0.68)	(57.68/16828.23) * 100 = (-0.34)
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	3910.00/20735.97 = 0.18	1922.41/18747.60 = 0.10
13	Debt Equity Ratio	3910.00/16825.97 = 0.23	1922.41/16825.19 = 0.11
14	Capitalization ratio	211.35/ (211.35+ 16825.97) = 0.012	0(Zero long term debt)
15	Cash flow to Debt Ratio	117.67/3910.00 = (-0.03)	57.68/ 1922.41 = (-0.03)
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	91.69/ 4.73 = 19.38	12.01/ 1.92 = 6.25
17	Fixed Asset Turnover Ratio	(366.12/408.41) = 0.89	250.85/ 84.49 = 2.96
18	Inventory Turnover Ratio	NA	NA
19	Operating Ratio	304.98/91.69 = 3.32	144.72/ 12.01 = 12.04
20	Total asset Turnover Ratio	91.69/ 20735.97 = 0.0044	12.01/ 18747.60 = 0.0006

Table 4.8: Calculation of the financial ratios for Reliance Power

4.5 Central Mine Planning and Design Institute Limited (CMPDIL)

The Central Mine Planning and Design Institute is a fully owned subsidiary of Coal India Limited, engaged in the field of environmental engineering and provides consultancy and engineering services across the globe. It is a public sector undertaking under the Government of India and is rated as a Schedule-B and Mini Ratna-II company. The company has its headquarters in Ranchi, Jharkhand and is involved in mineral exploration, resource evaluation, resource management, mining geology, hydro-geological and geophysical studies and engineering geology investigations. It is an ISO 9001 accredited company.

Serial No	**Entities (In crores)**	**As at March 31st, 2014**	**As at March 31st, 2013**
1	Equity Share Capital	19.04	19.04
2	Reserves	136.84	115.85
3	Net worth/Shareholder's fund	155.88	134.89
4	Long term debt	0	0
5	Receivables	198.34	323.80
6	Current Liabilities	491.13	446.06
7	Total Liabilities	674.64	628.17
8	Capital work in progress	25.59	11.37
9	Investment	0	0
10	Inventories	5.77	6.04
11	Cash & Cash equivalent	109.18	117.89
12	Current Assets	629.85	580.21
13	Fixed Assets	97.04	86.55
14	Total Assets	830.52	763.06
15	Capital Employed	339.39	317.00
16	Net Sales	647.43	601.21
17	Total Revenue	652.44	605.21
18	Cost of Goods sold	387.63	385.10
19	Total Expense	618.35	570.25
20	Gross Profit	259.80	215.95
21	Operating profit/ Cash flow from operations	75.47	68.80
22	EBDIT	34.09	34.96
23	Net Profit	19.57	25.05

Table 4.9: Important data from the financial statements of CMPDI

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	629.85 – 491.13 = 138.72	580.21 – 446.06 = 134.15
2	Current Ratio	629.85 / 491.13 = 1.27	580.21 / 446.06 = 1.30
3	Quick/Acid test Ratio	(629.85- 5.77)/ 491.13 = 1.27	(580.21/ 6.04) / 446.06 = 1.28
4	Cash Ratio	109.18/ 491.13 = 0.22	117.89/446.06 = 0.26
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(259.80/ 647.43)* 100 = 40.12	(215.95/ 601.05) * 100 = 35.92
6	Operating Profit Margin (In %)	(75.47/647.43)* 100 = 11.65	(68.80/ 601.05) * 100 = 11.44
7	Net Profit Margin (In %)	(19.57/647.43)* 100 = 3.02	(25.05/ 601.05) * 100 = 4.16
8	Return on Assets (In %)	(75.47/ 830.52)* 100 = 9.08	(68.80/ 763.06)* 100 = 9.01
9	Return on Investment (In %)	NA	NA
10	Return on Equity (In %)	(19.57/ 155.88)* 100 = 12.55	(25.05/ 134.89)* 100 = 18.57
11	Return on Capital Employed (In %)	(75.47/ 339.39)* 100 = 22.23	(68.80/ 317.00)* 100 = 21.70
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	674.64/ 830.52 = 0.81	628.17/ 763.06 = 0.82
13	Debt Equity Ratio	674.64/ 155.88 = 4.32	628.17/ 134.89 = 4.65
14	Capitalization ratio	NA	NA
15	Cash flow to Debt Ratio	75.47/674.64 = 0.11	68.80/ 628.17 = 0.10
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	647.43/ 198.34 = 3.26	601.05/ 323.80 = 1.85
17	Fixed Asset Turnover Ratio	652.44/ 97.04 = 6.72	605.21/86.55 = 6.99
18	Inventory Turnover Ratio	387.63/ 5.77 = 67.18	385.1/ 6.04 = 63.75
19	Operating Ratio	618.35/ 647.43 = 0.95	570.25/ 601.05 = 0.94
20	Total asset Turnover Ratio	647.43/ 830.52 = 0.77	601.05/ 763.06 = 0.78

Table 4.10: Calculation of the financial ratios for CMPDI

4.6 Coal India Limited (Standalone)

Coal India Limited (CIL) is an Indian state-controlled coal mining company headquartered in Kolkata, West Bengal, India. It is the largest coal producer company in the world and contributes around 81% of the coal production in India. It produced 452 million tonnes of coal during FY 2012–13 and earned a revenue of INR 882.81 billion from sale of coal in the same financial year. As on 30 January 2015, Union Government of India owns 89.65% of the shares in CIL and controls the operations of CIL through Ministry of Coal. In April 2011, CIL was conferred the Maharatna status by the Union Government of India. On 31 March 2013, its market capitalization was INR 1.952 trillion (US $35.9 billion) making it India's 5th most valuable company by market value.

Serial No	Entities (In crores)	As at March 31st, 2014	As at March 31st, 2013
1	Equity Share Capital	6316.36	6316.36
2	Reserves	10128.88	14199.80
3	Net worth/Shareholder's fund	16445.24	20516.16
4	Long term debt	0	914.39
5	Receivables	15.11	1.48
6	Current Liabilities	5888.97	10138.81
7	Total Liabilities	8596.35	13520.96
8	Capital work in progress	186.27	107.46
9	Investment	9648.94	9026.07
10	Inventories	39.87	15.66
11	Cash & Cash equivalent	9817.84	18104.28
12	Current Assets	15215.72	23144.66
13	Fixed Assets	299.98	218.52
14	Total Assets	25041.59	34037.12
15	Capital Employed	19152.62	23898.31
16	Net Sales	16089.85	11088.01
17	Total Revenue	16404.10	11440.26
18	Cost of Goods sold	349.21	367.74
19	Total Expense	983.63	1102.23
20	Gross Profit	15740.64	10720.27
21	Operating profit/ Cash flow from operations	15233.26	10182.22
22	EBDIT	15420.47	10338.03
23	Net Profit	15008.54	9794.32

Table 4.11: Important data from the financial statements of CIL (Standalone)

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	15215.72- 5888.97 = 9326.75	23144.66- 10138.81 = 13005.85
2	Current Ratio	15215.72/ 5888.97 = 2.58	23144.66/ 10138.81 = 2.28
3	Quick/Acid test Ratio	(15215.72 – 39.87) / 5888.97 = 2.57	(23144.66- 15.66) / 10138.81 = 2.28
4	Cash Ratio	9817.84/ 5888.97 = 1.66	18104.28/ 10138.81 = 1.78
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(15740.64/ 16089.85)* 100 = 97.82	(10720.27/ 11088.01)* 100 = 96.68
6	Operating Profit Margin (In %)	(15233.26/ 16089.85)* 100 = 94.67	(10182.22/ 11088.01)* 100 = 91.83
7	Net Profit Margin (In %)	(15008.54/ 16089.85)* 100 = 93.27	(9794.32/ 11088.01)* 100 = 88.33
8	Return on Assets (In %)	(15233.26/ 25041.59)* 100 = 60.83	(10182.22/ 34037.12)* 100 = 29.12
9	Return on Investment (In %)	(15008.54/ 9648.94)* 100 = 155.50	(9794.32/ 9026.07)* 100 = 108.50
10	Return on Equity (In %)	(15008.54/ 16445.24)* 100 = 91.26	(9794.32/ 20516.16)* 100 = 47.73
11	Return on Capital Employed (In %)	(15233.26/ 19152.62)* 100 = 79.53	(10182.22/ 23898.31)* 100 = 42.60
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	8596.35/ 25041.59 = 0.34	13520.96/ 34037.12 = 0.39
13	Debt Equity Ratio	8596.35/ 16445.24 = 0.52	13520.96/ 20516.16 = 0.65
14	Capitalization ratio	NA	914.39/ (914.39+ 20516.16) = 0.042
15	Cash flow to Debt Ratio	15233.26/8596.35 = 1.77	10182.22/ 13520.96 = 0.75
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	16089.85/15.11 = 1064.84	11088.01/ 1.48 = 7491.89
17	Fixed Asset Turnover Ratio	16404.10/ 299.98 = 54.68	11440.26/ 218.52 = 52.35
18	Inventory Turnover Ratio	349.21/ 39.87 = 8.75	367.74/ 15.66 = 23.48
19	Operating Ratio	983.63/ 16089.85 = 0.06	1102.23/ 11088.01 = 0.09
20	Total asset Turnover Ratio	16089.85/ 25041.59 = 0.64	11088.01/ 34037.12 = 0.32

Table 4.12: Calculation of the financial ratios for CIL (Standalone)

4.7 Coal India Limited (Consolidated)

Coal India Limited (CIL) is an Indian state-controlled coal mining company headquartered in Kolkata, West Bengal, India. It is the largest coal producer company in the world and contributes around 81% of the coal production in India. It produced 452 million tonnes of coal during FY 2012–13 and earned a revenue of INR 882.81 billion from sale of coal in the same financial year. As on 30 January 2015, Union Government of India owns 89.65% of the shares in CIL and controls the operations of CIL through Ministry of Coal. In April 2011, CIL was conferred the Maharatna status by the Union Government of India. On 31 March 2013, its market capitalization was INR 1.952 trillion (US $35.9 billion) making it India's 5th most valuable company by market value.

Serial No	Entities (In crores)	As at March 31st, 2014	As at March 31st, 2013
1	Equity Share Capital	6316.36	6316.36
2	Reserves	36088.10	42155.63
3	Net worth/Shareholder's fund	42404.46	48471.99
4	Long term debt	3700.40	4215.00
5	Receivables	8241.03	10480.21
6	Current Liabilities	24434.88	26400.87
7	Total Liabilities	61774.29	61760.22
8	Capital work in progress	2836.48	2216.02
9	Investment	3774.9	2394.96
10	Inventories	5568.07	5617.83
11	Cash & Cash equivalent	52389.53	62236.00
12	Current Assets	80226.55	88423.25
13	Fixed Assets	19100.20	16931.71
14	Total Assets	104242.35	110295.81
15	Capital Employed	79807.47	83894.94
16	Net Sales	68810.02	68302.74
17	Total Revenue	77779.40	77049.43
18	Cost of Goods sold	37166.36	36210.29
19	Total Expense	54901.27	52077.25
20	Gross Profit	31643.66	32092.45
21	Operating profit/ Cash flow from operations	19751.59	21598.74
22	EBDIT	22878.13	24972.18
23	Net Profit	15111.67	17356.36

Table 4.13: Important data from the financial statements of CIL (Consolidated)

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	80226.55 – 24434.88 = 55791.67	88423.25 – 26400.87 = 62022.38
2	Current Ratio	80226.55 / 24434.88 = 3.28	88423.25 / 26400.87 = 3.34
3	Quick/Acid test Ratio	(80226.55 – 5568.07)/ 24434.88 = 3.05	(88423.25 – 5617.83)/ 26400.87 = 3.13
4	Cash Ratio	52389.53/ 24434.88 = 2.14	62236.00/ 26400.87 = 2.35
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(31643.66/ 68810.02)* 100 = 45.98	(32092.45/ 68302.74)* 100 = 46.63
6	Operating Profit Margin (In %)	(19751.59/ 68810.02)* 100 = 28.70	(21598.74/ 68302.74)* 100 = 31.38
7	Net Profit Margin (In %)	(15111.67/ 68810.02)* 100 = 21.96	(17356.36/ 68302.74)* 100 = 25.22
8	Return on Assets (In %)	(19751.59/ 104242.35)* 100 = 18.94	(21598.74/ 110295.81)* 100 = 19.58
9	Return on Investment (In %)	(15111.67/ 3774.9)* 100 = 400.30	(17356.36/ 2394.96)* 100 = 724.70
10	Return on Equity (In %)	(15111.67/ 42404.96)* 100 = 35.63	(17356.36/ 48471.99)* 100 = 35.80
11	Return on Capital Employed (In %)	(19751.59/ 79807.47)* 100 = 24.74	(21598.74/ 83894.94)* 100 = 25.74
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	61774.29/ 104242.35 = 0.59	61760.22/ 110295.81 = 0.55
13	Debt Equity Ratio	61774.29/ 42404.46 = 1.45	61760.22/ 48471.99 = 1.27
14	Capitalization ratio	3700.4/ (3700.4+ 42404.46) = 0.080	4215.0/ (4215.0 + 48471.99) = 0.08
15	Cash flow to Debt Ratio	19751.59/ 61774.29 = 0.31	21598.74/ 61760.22 = 0.34
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	68810.02/ 8241.03 = 8.34	68302.74/ 10480.21 = 6.51
17	Fixed Asset Turnover Ratio	77779.40/ 19100.20 = 4.07	77049.43/ 16931.71 = 4.55
18	Inventory Turnover Ratio	37166.36/ 5568.07 = 6.67	36210.29/ 5617.83 = 6.44
19	Operating Ratio	54901.27/ 68810.02 = 0.79	52077.25/ 68302.74 = 0.76
20	Total asset Turnover Ratio	68810.02/ 104242.38 = 0.66	68302.74/ 110295.81 = 0.61

Table 4.14: Calculation of the financial ratios for CIL (Consolidated)

4.8 Adani Enterprise

Adani Group is an Indian multinational conglomerate company headquartered in Ahmedabad, Gujarat, India. Its diversified businesses include resources, logistics, agribusiness and energy sectors. Adani Enterprises is the largest trading house of India in importing coal with a market share 60%. It also supplies coal to NTPC, India. Adani group became India's largest private coal mining company after Adani Enterprises won the Orissa mine rights. In 2011, Port of Dahej became operational and now has a capacity of 20 million MT capacity. The company also bought Galilee Basin mine in Australia with 10.4 billion MT of coal reserves. It also commissioned 60 million MT of handling capacity coal import terminal in Mundra, making it the world's largest.

Serial No	Entities (In crores)	As at March 31st, 2014	As at March 31st, 2013
1	Equity Share Capital	109.98	109.98
2	Reserves	9924.29	10256.96
3	Net worth/Shareholder's fund	10034.27	10366.94
4	Long term debt	2040.58	1490.00
5	Receivables	3113.02	3698.32
6	Current Liabilities	10226.03	8026.68
7	Total Liabilities	12522.81	9935.73
8	Capital work in progress	254.86	163.49
9	Investment	6551.59	4066.69
10	Inventories	1068.51	736.71
11	Cash & Cash equivalent	260.88	1898.88
12	Current Assets	10495.44	9422.88
13	Fixed Assets	1178.83	1080.48
14	Total Assets	22557.08	20302.67
15	Capital Employed	12331.05	12275.99
16	Net Sales	11789.31	11890.88
17	Total Revenue	12993.46	12504.28
18	Cost of Goods sold	10450.00	10101.40
19	Total Expense	13355.78	12096.12
20	Gross Profit	1339.31	1789.48
21	Operating profit/ Cash flow from operations	429.98	1363.71
22	EBDIT	-362.32	408.16
23	Net Profit	-178.70	519.84

Table 4.15: Important data from the financial statements of Adani Enterprise

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	10495.44 – 10226.03= 269.41	9422.88 – 8026.68 = 1396.20
2	Current Ratio	10495.44 / 10226.03 = 1.02	9422.88 / 8026.68 = 1.17
3	Quick/Acid test Ratio	(10495.44- 1068.51) / 10226.03 = 0.92	(9422.88 – 736.71) / 8026.68 = 1.08
4	Cash Ratio	260.88 / 10226.03 = 0.02	1898.88/ 8026.68 = 0.23
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(1339.31/11789.31) * 100 = 11.36	(1789.48/ 11890.88)* 100 = 15.04
6	Operating Profit Margin (In %)	(429.98/ 11890.88)* 100 = 3.64	(1363.71/ 11890.88)* 100 = 11.46
7	Net Profit Margin (In %)	(-178.70/11789.31) * 100 = (-1.5)	(519.84/ 11890.88)* 100 = 4.37
8	Return on Assets (In %)	(429.48/ 22557.08)* 100 = 1.90	(1363.71/ 20302.67)* 100 = 6.71
9	Return on Investment (In %)	(-178.70/6551.59) * 100 = (-2.72)	(519.84/ 4066.69)* 100 = 12.78
10	Return on Equity (In %)	(-178.70/10034.27) * 100 = (-1.78)	(519.84/ 10366.94)* 100 = 5.01
11	Return on Capital Employed (In %)	(429.48/ 12331.05)* 100 = 3.48	(1363.71/ 12275.99)* 100 = 11.10
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	12522.81/22557.08 = 0.55	9935.73/ 20302.67 = 0.48
13	Debt Equity Ratio	12522.81/ 10034.27 = 1.24	9935.73/ 10366.94 = 0.95
14	Capitalization ratio	2040.58/ (2040.58+ 10034.27) = 0.168	1490.00/ (1490.00+ 10366.94) = 0.125
15	Cash flow to Debt Ratio	429.98/ 12522.81 = 0.034	1363.71 / 9935.73 = 0.13
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	11789.31/ 3113.02 = 3.78	11890.88/ 3698.32 = 3.21
17	Fixed Asset Turnover Ratio	12993.46/1178.83 = 11.02	12504.28/ 1080.48 = 11.57
18	Inventory Turnover Ratio	10450.00/ 1068.51 = 9.77	10101.4/ 736.71 = 13.71
19	Operating Ratio	13355.78/ 11789.31 = 1.13	12096.12/ 11890.88 = 1.01
20	Total asset Turnover Ratio	11789.31/ 22557.08 = 0.52	11890.88/ 20302.67 = 0.58

Table 4.16: Calculation of the financial ratios for Adani Enterprise

4.9 Singareni Collieries Company Limited (SCCL)

The Singareni Collieries Company Limited or SCCL is a government-owned coal mining company in India. It is named after the village Singareni in Khammam district, Telangana (former A,P.,) where the coal mines are first noticed .One of the public sector undertakings, the company is jointly owned by the Telangana government (51 percent) and the Union Government (49 percent). The Union Government's administration of the company is through the Ministry of Coal. SCCL is currently operating 16 opencast and 32 underground mines in 4 districts of Telangana with a manpower around 62,805. Mining activities of SCCL are presently spread over four districts of Telangana Viz. Adilabad, Karimnagar, Khammam and Warangal.

Serial No	**Entities (In crores)**	**As at March 31st, 2014**	**As at March 31st, 2013**
1	Equity Share Capital	1733.20	1733.20
2	Reserves	1699.30	1399.55
3	Net worth/Shareholder's fund	3432.50	3132.75
4	Long term debt	1028.48	616.61
5	Receivables	1225.18	802.59
6	Current Liabilities	3322.65	2723.48
7	Total Liabilities	12591.12	9544.15
8	Capital work in progress	1603.42	320.55
9	Investment	1022.80	23.13
10	Inventories	671.43	575.97
11	Cash & Cash equivalent	3262.40	3711.67
12	Current Assets	5902.78	5736.82
13	Fixed Assets	5721.60	4105.25
14	Total Assets	16023.62	12676.90
15	Capital Employed	12700.97	9953.42
16	Net Sales	10231.75	9322.23
17	Total Revenue	10804.62	9816.55
18	Cost of Goods sold	2131.09	1604.61
19	Total Expense	10246.08	9247.59
20	Gross Profit	8100.66	7717.62
21	Operating profit/ Cash flow from operations	2777.49	2497.85
22	EBDIT	558.54	568.96
23	Net Profit	401.14	358.27

Table 4.17: Important data from the financial statements of SCCL

Sr No	Financial Ratios	As at March 31st, 2014	As at March 31st, 2013
A	***Liquidity Measurement Ratio***		
1	Net Working Capital (In crores)	5902.78– 3322.65 = 2580.13	5738.82- 2723.48 = 3013.34
2	Current Ratio	5902.78/ 3322.65 = 1.77	5738.82/ 2723.48 = 2.10
3	Quick/Acid test Ratio	(5902.78– 671.43)/ 3322.65 = 1.57	(5738.82- 575.97)/ 2723.48 = 1.36
4	Cash Ratio	3262.40/ 3322.65 = 0.98	3711.67/ 2723.48 = 1.36
B	***Profitability Indication Ratio***		
5	Gross Profit Margin (In %)	(8100.66/ 10231.75)* 100 = 79.17	(7717.62/ 9322.23) * 100 = 82.78
6	Operating Profit Margin (In %)	(2777.49/ 10231.75)* 100 = 27.14	(2497.85/ 9322.23) * 100 = 26.79
7	Net Profit Margin (In %)	(401.14/ 10231.75)* 100 = 3.92	(358.27/ 9322.23) * 100 = 3.84
8	Return on Assets (In %)	(2777.49/ 16023.62)* 100 = 17.33	(2497.85/ 12676.90) * 100 = 19.70
9	Return on Investment (In %)	(401.14/ 1022.80)* 100 = 39.21	(358.27/ 23.13) * 100 = 1548
10	Return on Equity (In %)	(401.14/ 3432.50)* 100 = 11.68	(358.27/ 3132.75) * 100 = 11.43
11	Return on Capital Employed (In %)	(2777.49/ 12700.97)* 100 = 21.86	(2497.85/ 9953.42) * 100 = 25.09
C	***Debt/Liabilities Ratio***		
12	Debt Ratio	12591.12/ 16023.62 = 0.78	9544.15/ 12676.90 = 0.75
13	Debt Equity Ratio	12591.12/ 3432.50 = 3.66	9544.18/ 3132.75 = 3.04
14	Capitalization ratio	1028.48/ (1028.48+ 3432.50) = 0.230	616.61/ (616.61+ 3132.75) = 0.164
15	Cash flow to Debt Ratio	2777.49/ 12591.12 = 0.22	2497.85/ 9544.18 = 0.26
D	***Operating Performance Ratio***		
16	Receivables Turnover Ratio	10231.75/ 1225.18 = 8.35	9322.23/ 802.59 = 11.61
17	Fixed Asset Turnover Ratio	10804.62/5721.60 = 1.88	9816.55/ 4105.25 = 2.39
18	Inventory Turnover Ratio	2131.09/ 671.43 = 3.17	1604.61/ 575.97 = 2.78
19	Operating Ratio	10246.08/ 10231.75 = 1.00	9247.59/ 9322.23 = 0.99
20	Total asset Turnover Ratio	10231.75/ 16023.62 = 0.63	9322.23/ 12676.90 = 0.73

Table 4.18: Calculation of the financial ratios for SCCL

4.10 Comparing the financial ratios of all the Coal Mining Companies

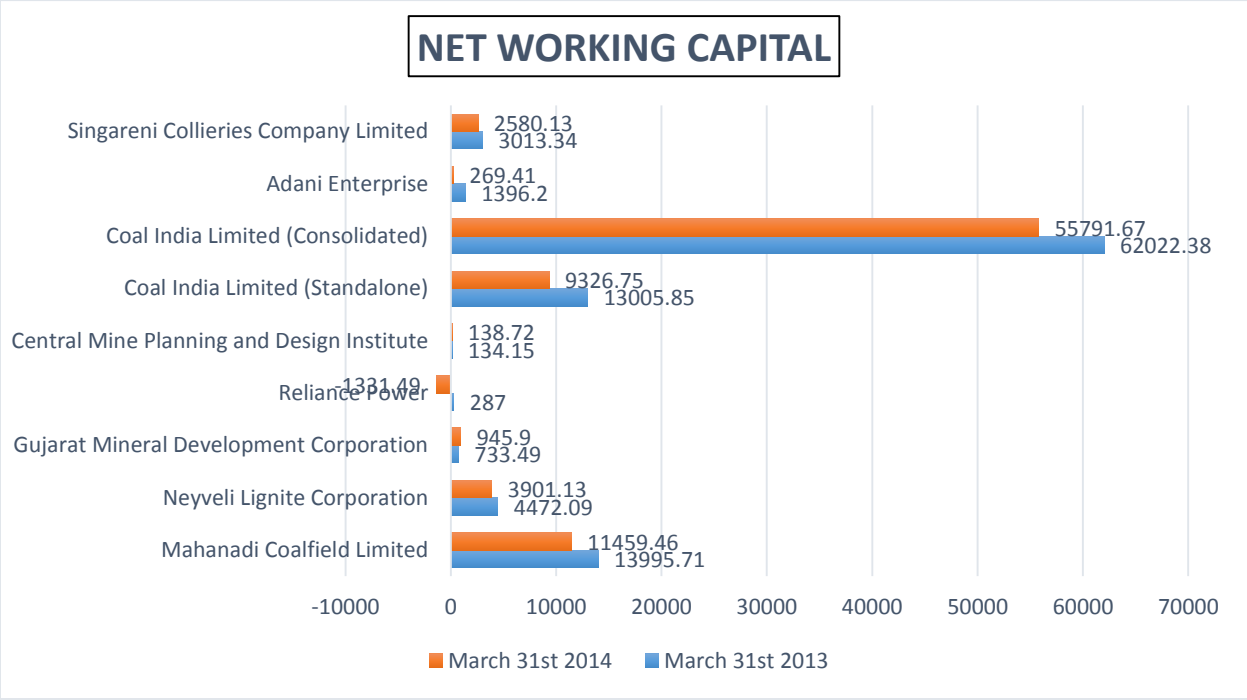


Figure 1: Comparison of the Net Working Capital among the Coal Mining Companies

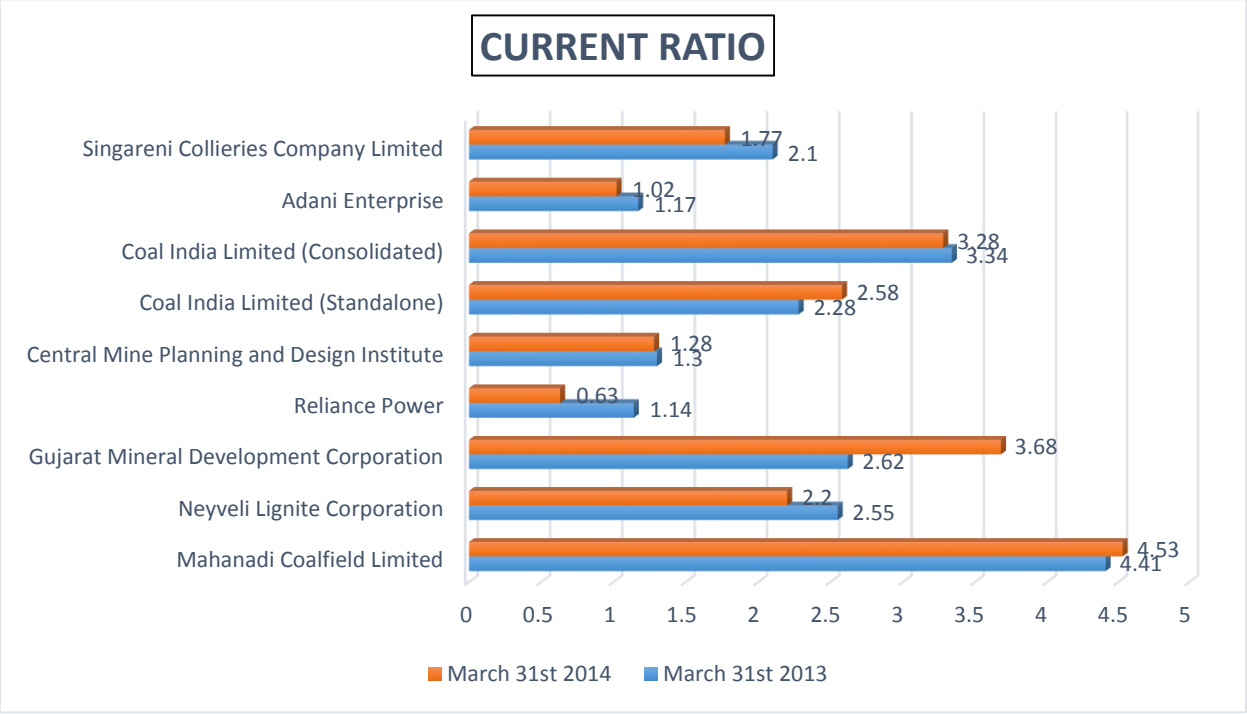


Figure 2: Comparison of the Current Ratio among the Coal Mining Companies

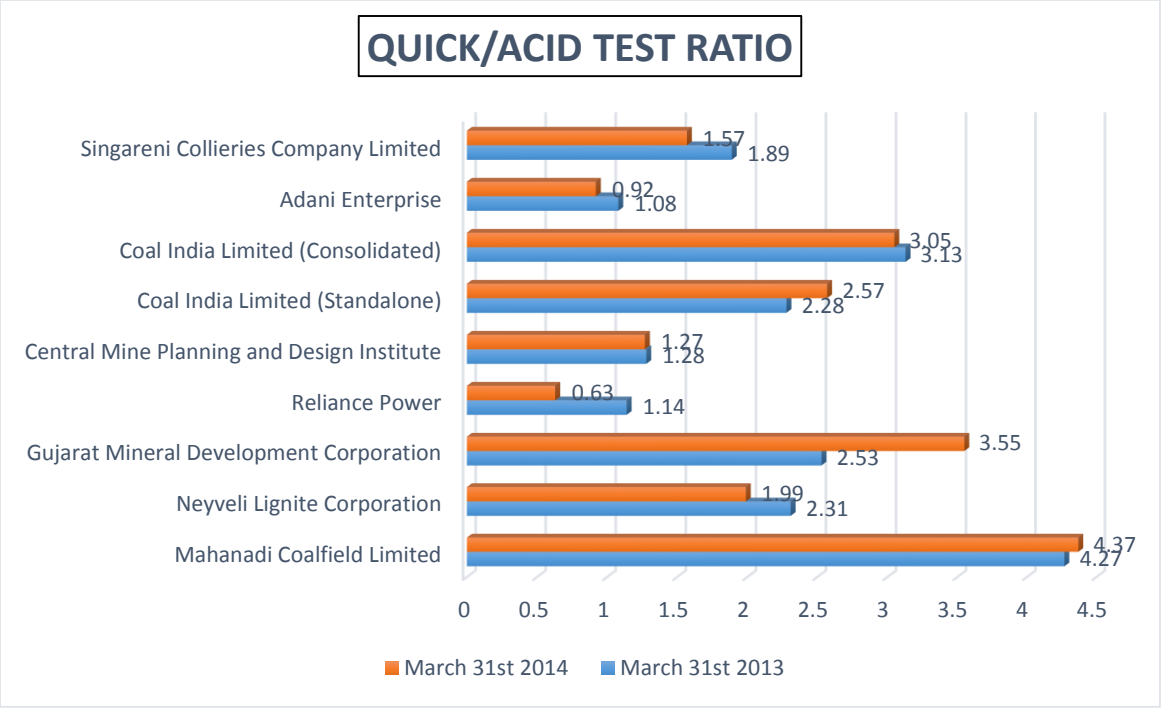


Figure 3: Comparison of the Quick/Acid test ratio among the Coal Mining Companies

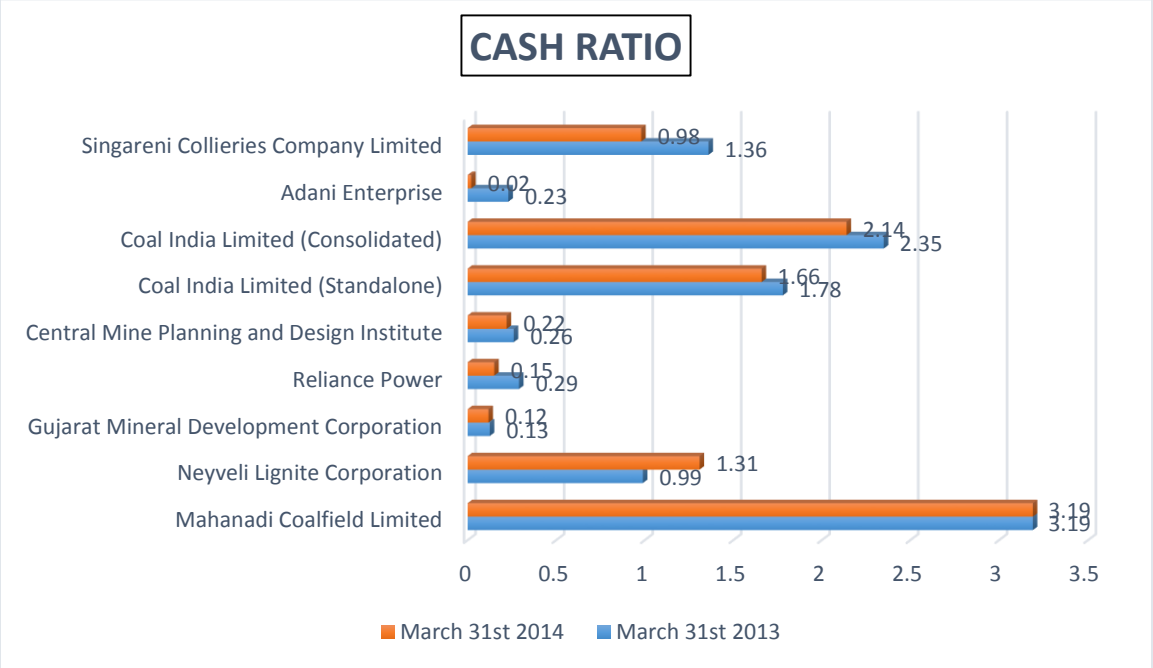


Figure 4: Comparison of the Cash Ratio among the Coal Mining Companies

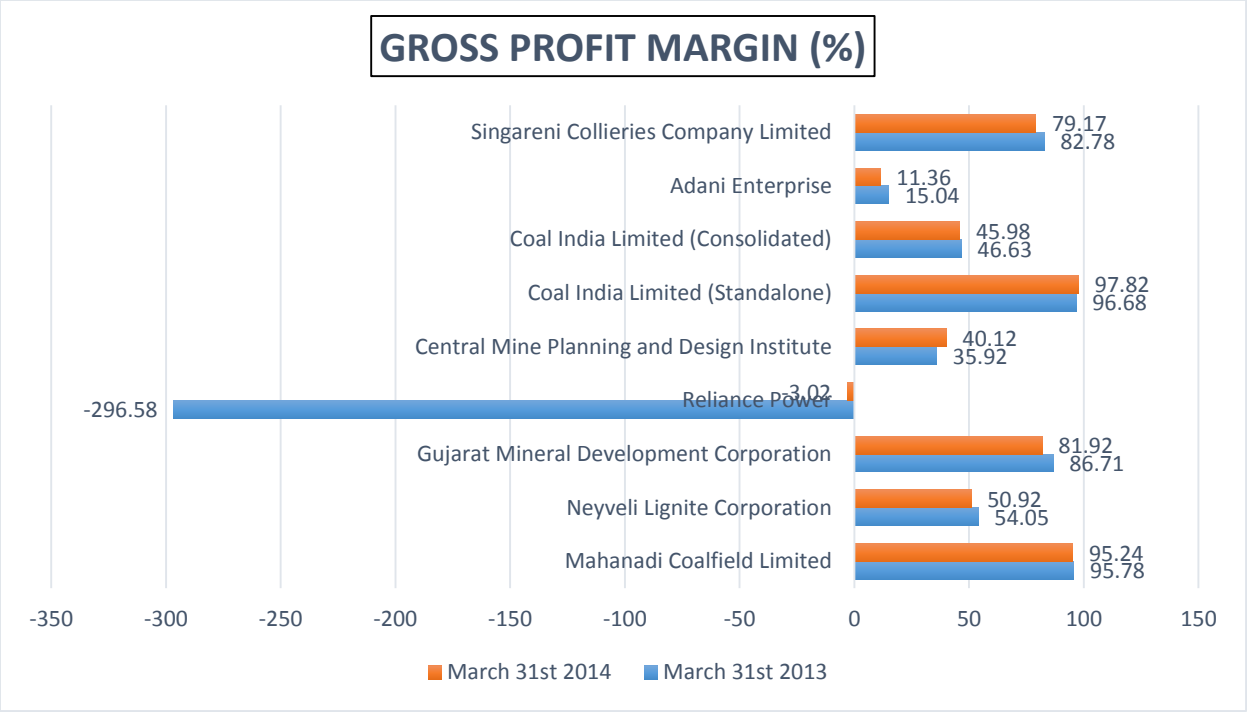


Figure 5: Comparison of the Gross Profit Margin (%) among the Coal Mining Companies

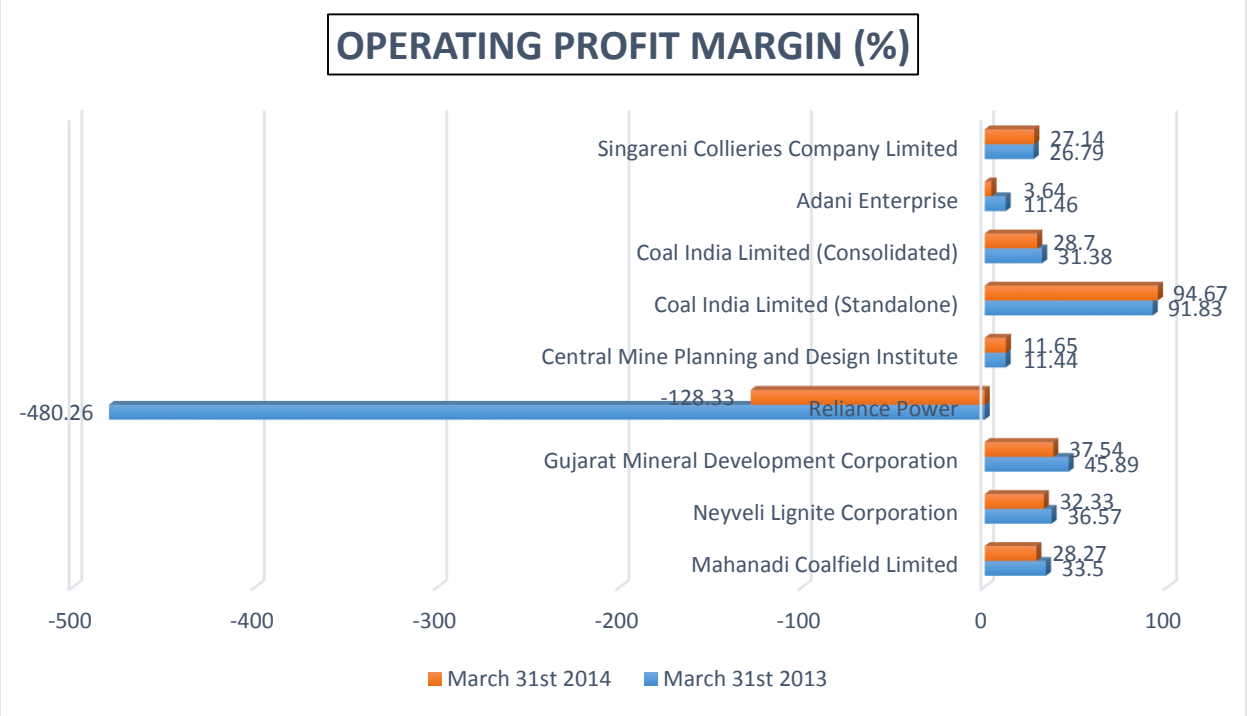


Figure 6: Comparison of the Operating Profit Margin (%) among the Coal Mining Companies

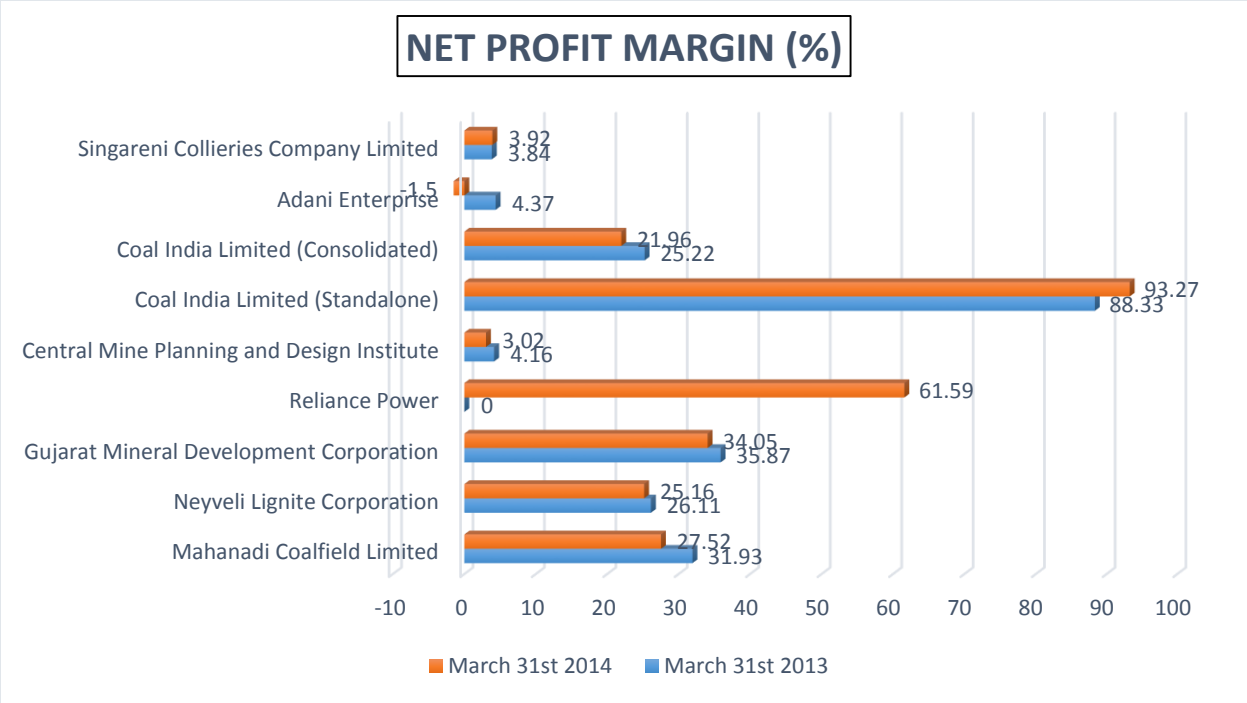


Figure 7: Comparison of the Net Profit Margin (%) among the Coal Mining Companies

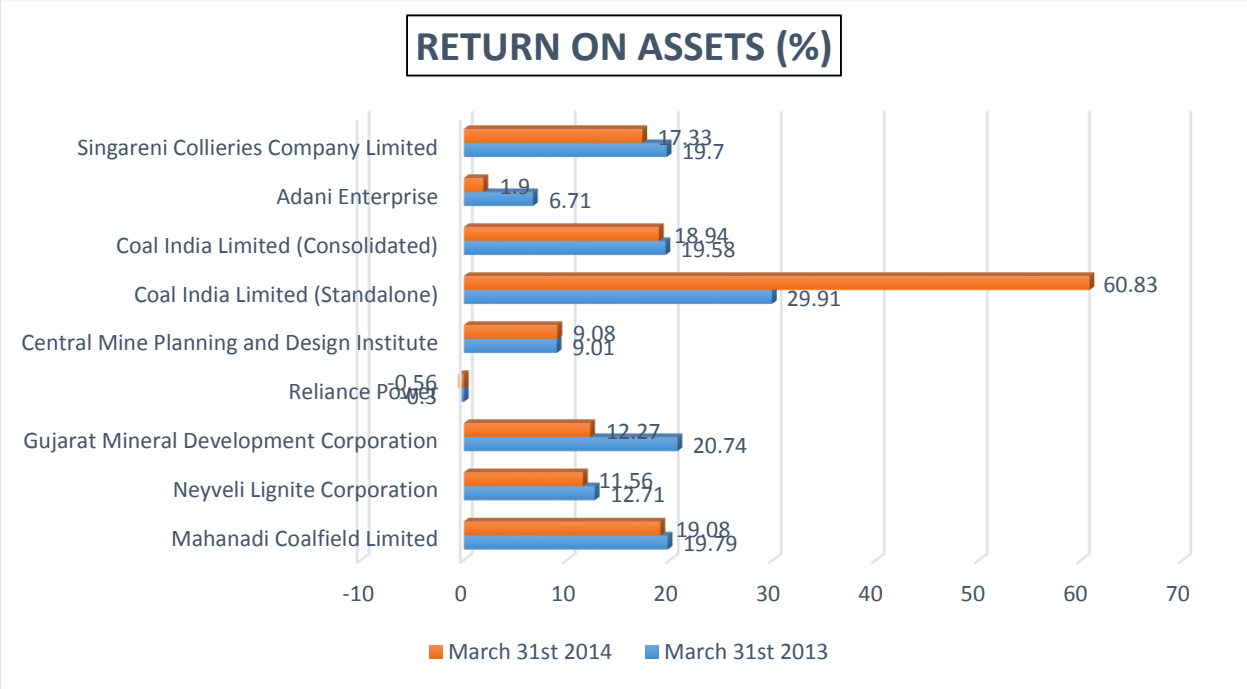


Figure 8: Comparison of the Return on Assets (%) among the Coal Mining Companies

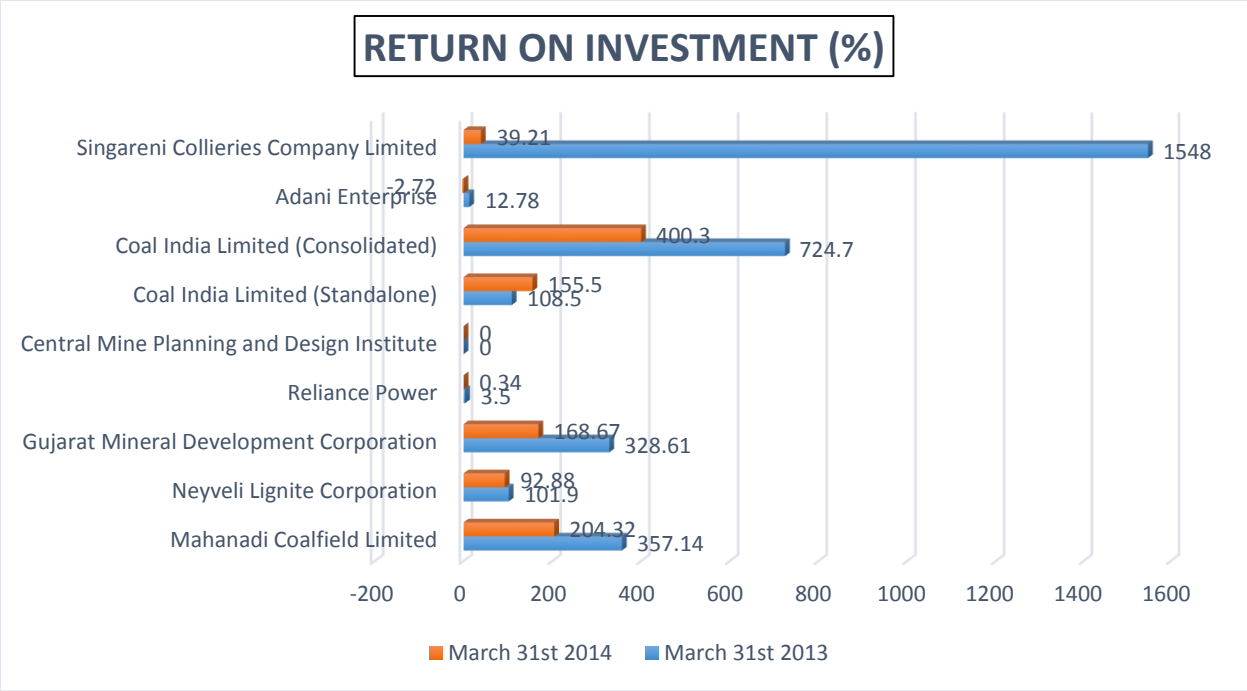


Figure 9: Comparison of the Return on Investment (%) among the Coal Mining Companies

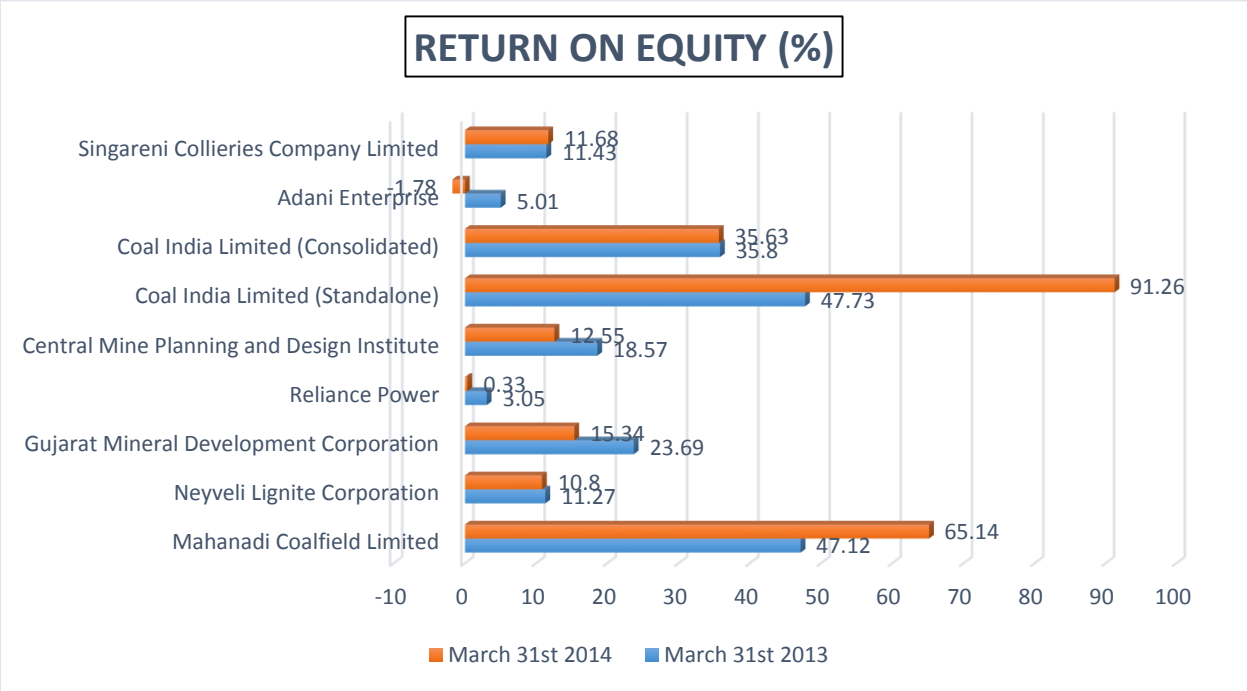


Figure 10: Comparison of the Return on Equity(%) among the Coal Mining Companies

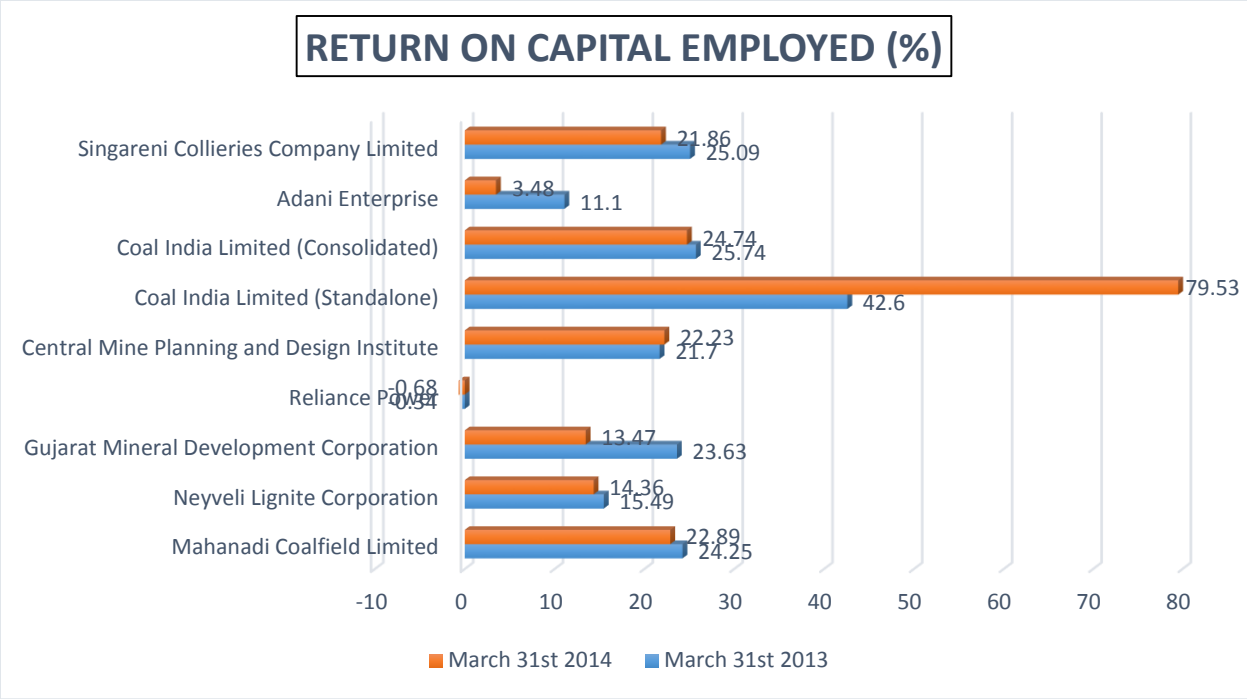


Figure 11: Comparison of the Return on Capital Employed (%) among the Coal Mining Companies

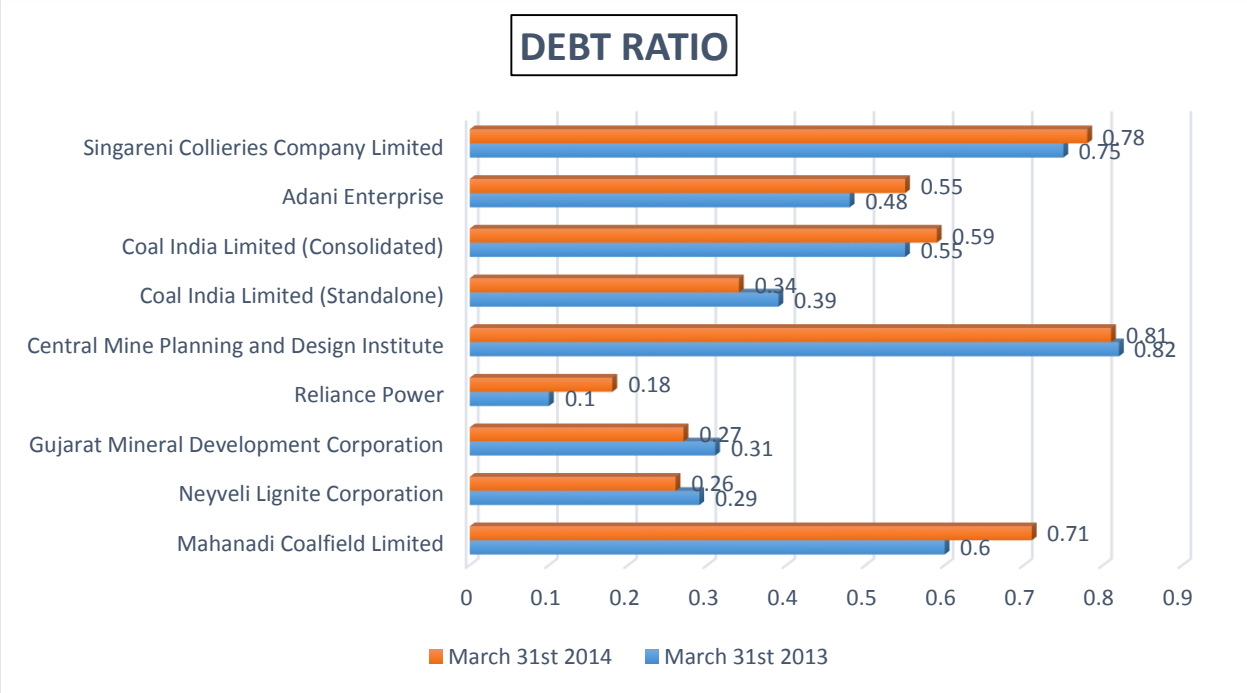


Figure 12: Comparison of the Debt Ratio among the Coal Mining Companies

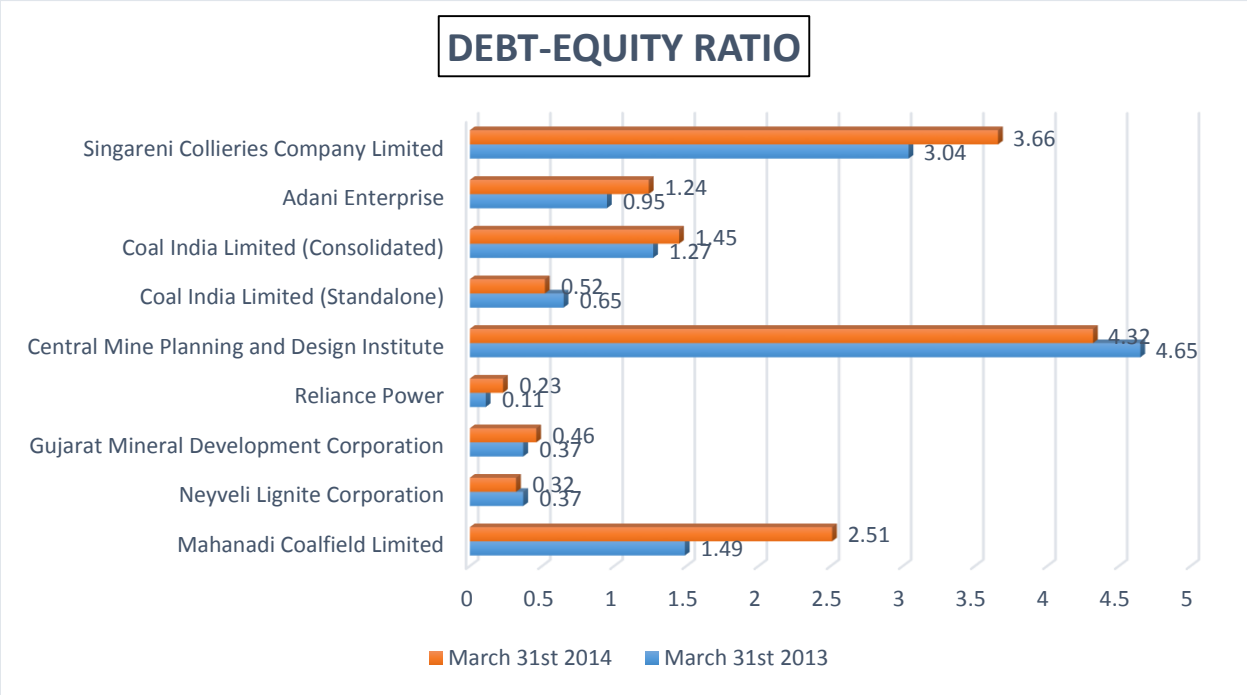


Figure 13: Comparison of the Debt-Equity Ratio among the Coal Mining Companies

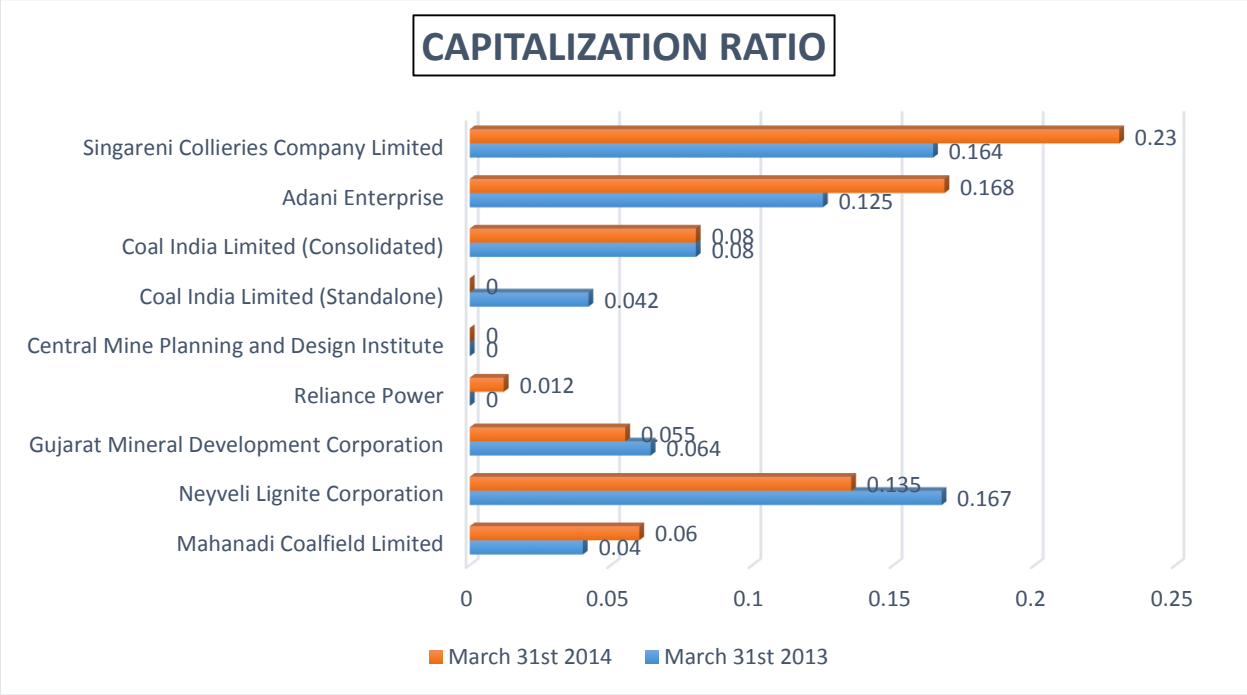


Figure 14: Comparison of the Capitalization Ratio among the Coal Mining Companies

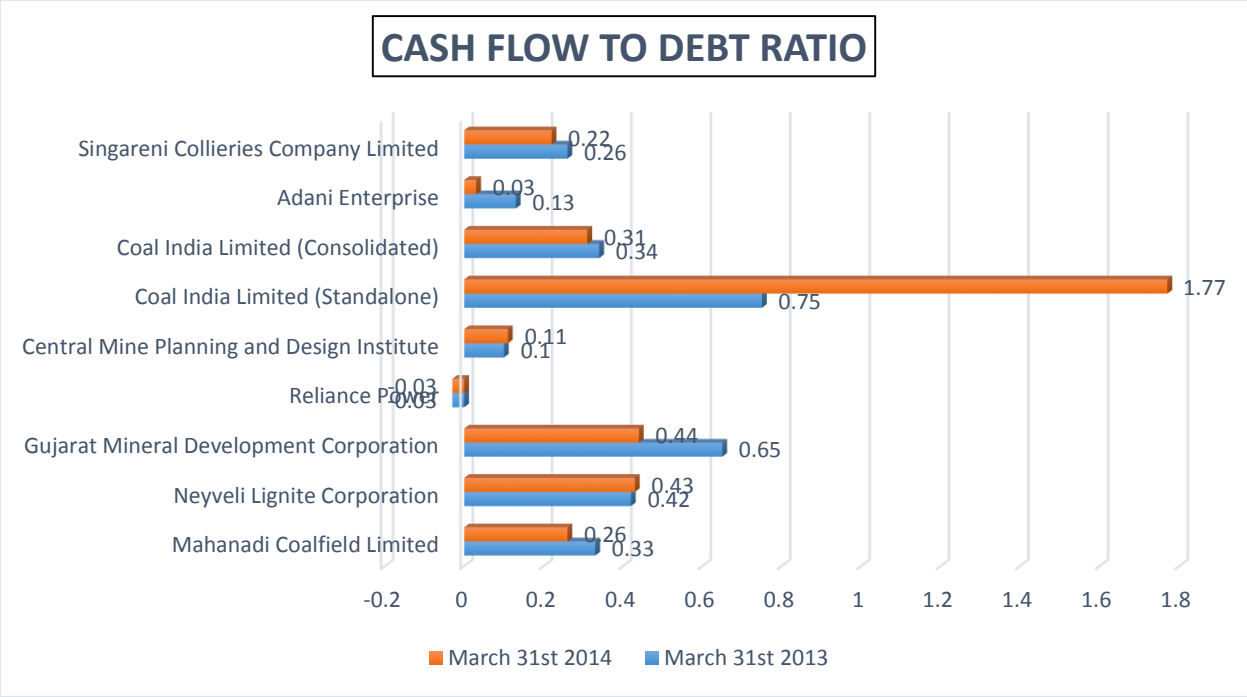


Figure 15: Comparison of the Cash flow to Debt Ratio among the Coal Mining Companies

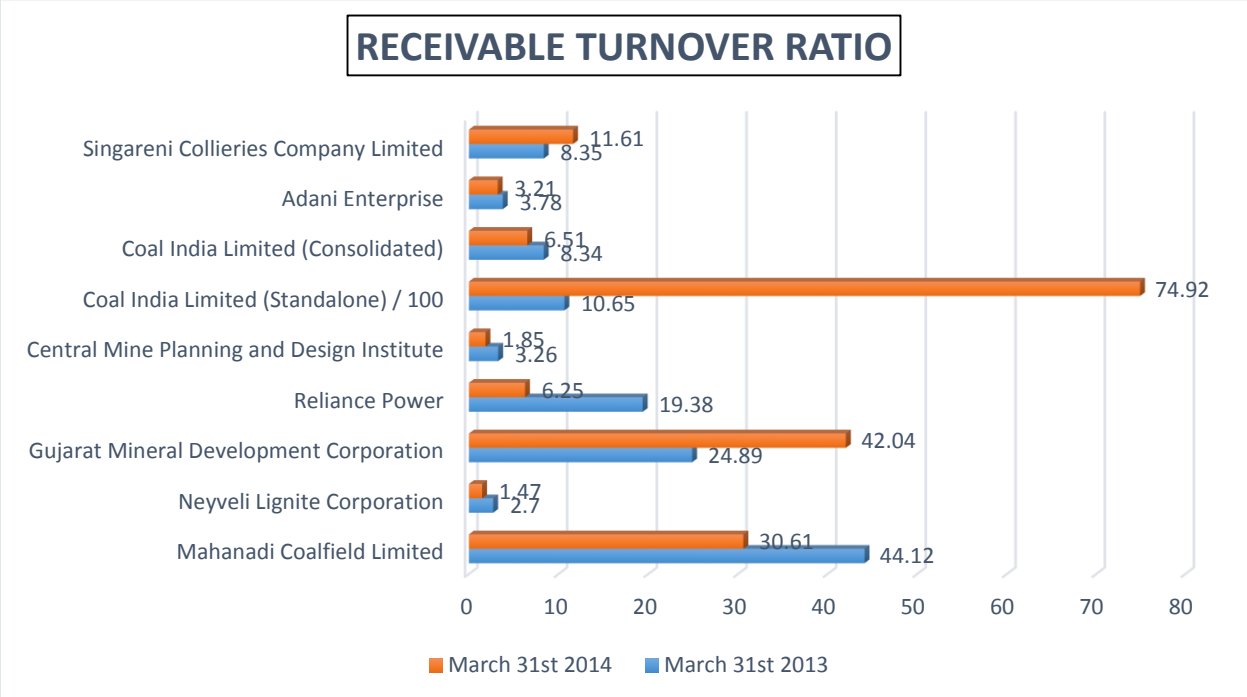


Figure 16: Comparison of the Receivables Turnover Ratio among the Coal Mining Companies

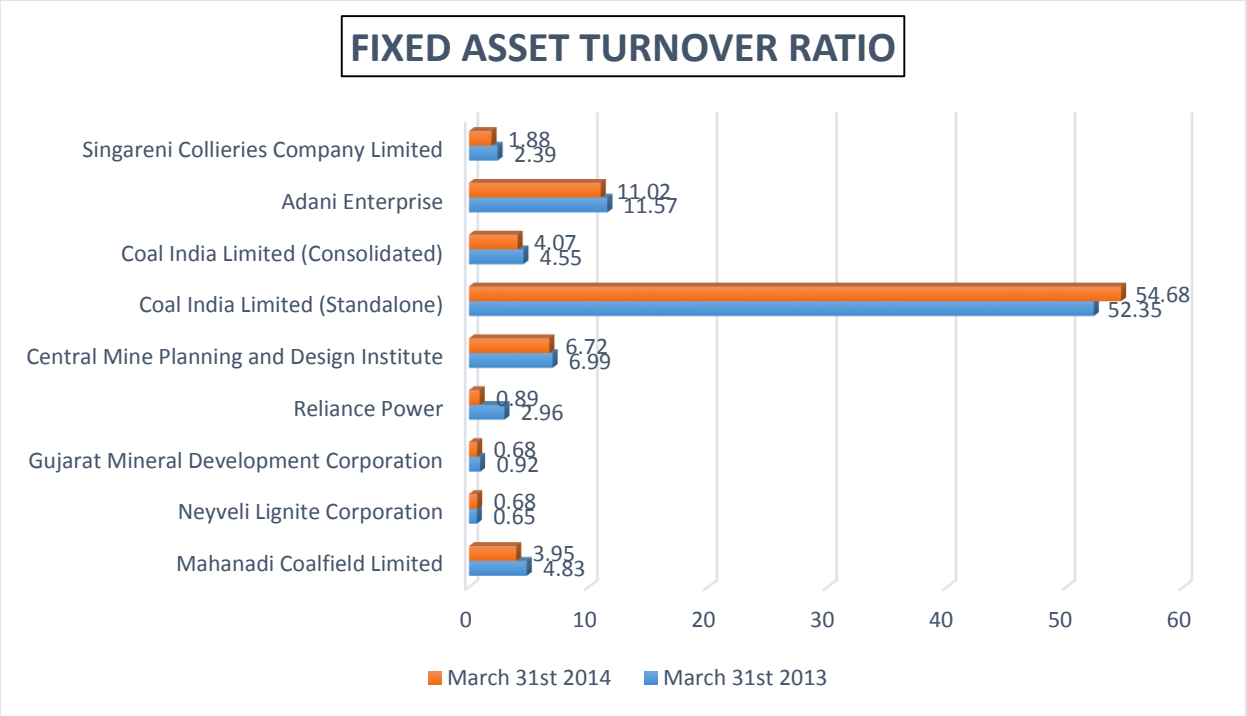


Figure 17: Comparison of the Fixed asset Turnover Ratio among the Coal Mining Companies

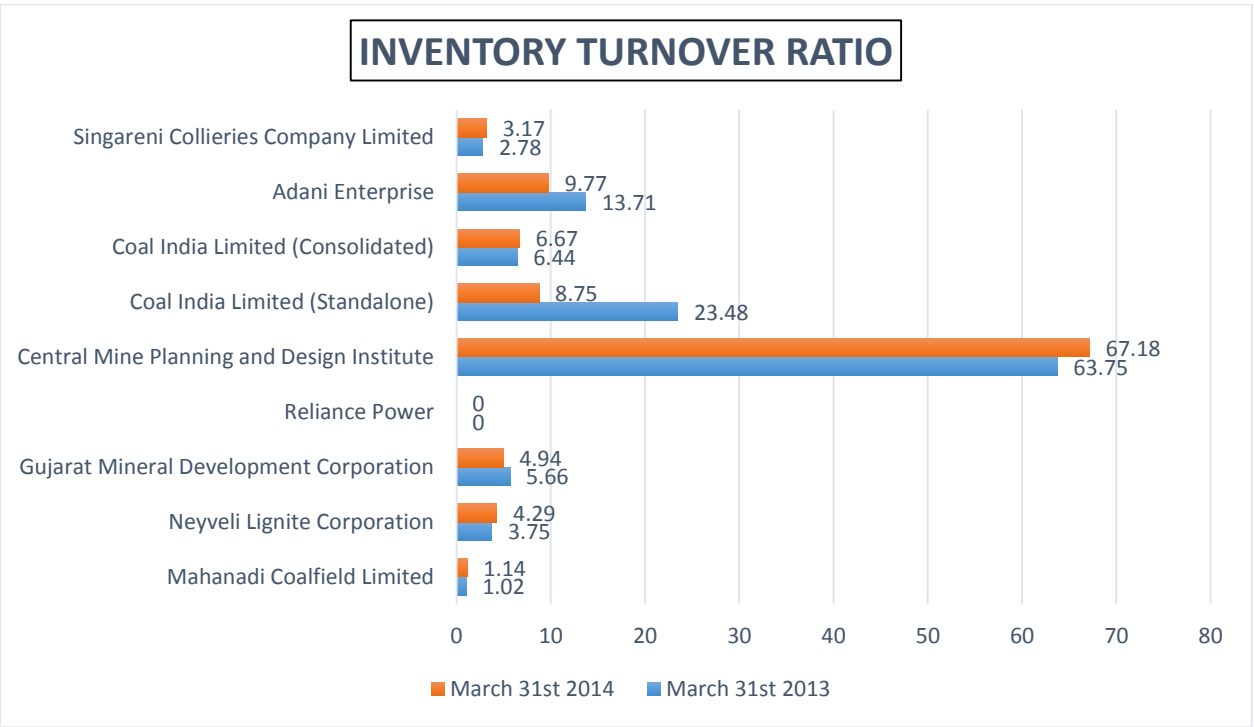


Figure 18: Comparison of the Inventory Turnover Ratio among the Coal Mining Companies

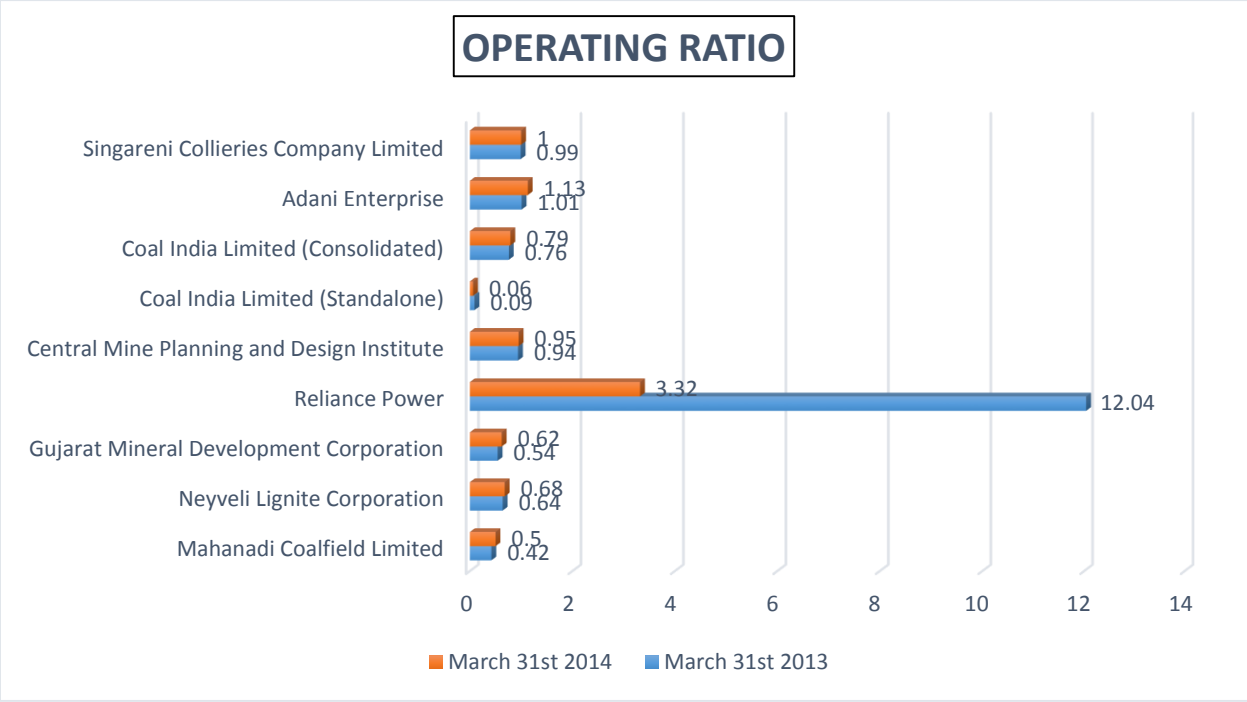


Figure 19: Comparison of the Operating Ratio among the Coal Mining Companies

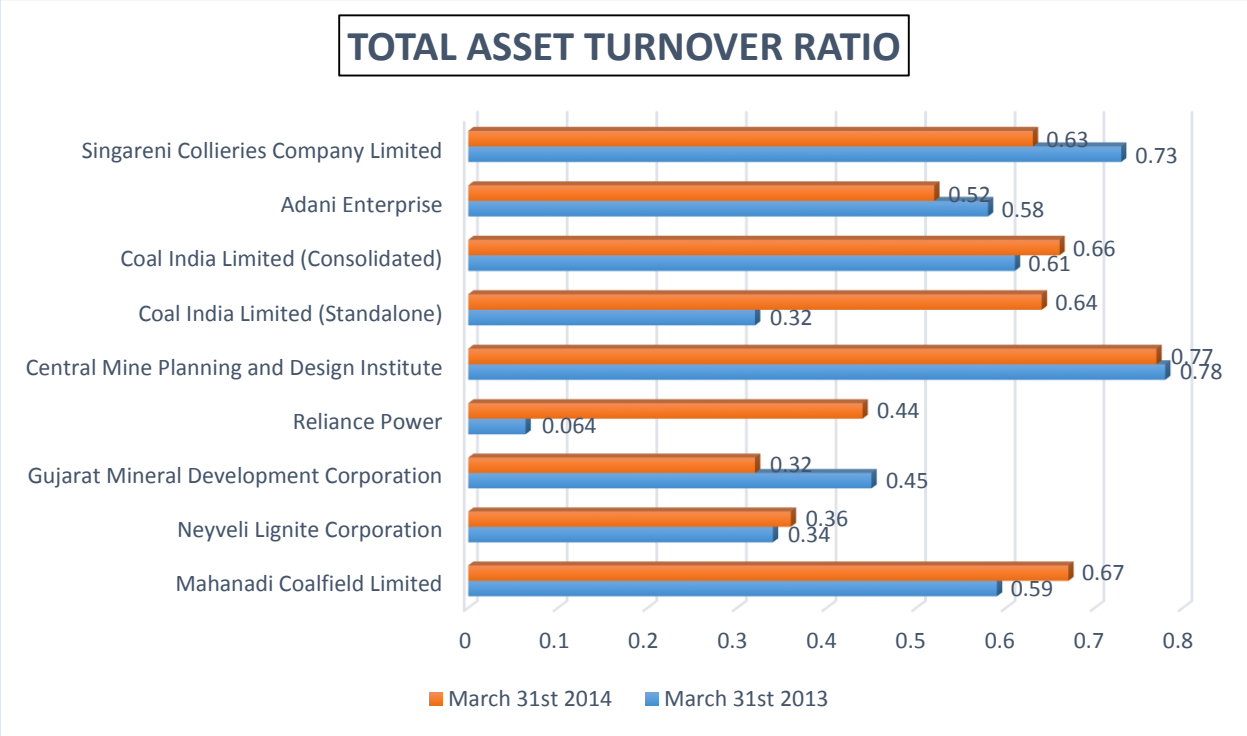


Figure 20: Comparison of the Total Asset Turnover Ratio among the Coal Mining Companies

4.11 Summary from the Graphs & Results

Sr No	Financial Ratios	Information
A	***Liquidity Measurement Ratio***	
1	Net Working Capital (In crores)	Highest :CIL (Consolidated) Lowest : Reliance Power Critical : Reliance Power as its value is negative
2	Current Ratio	Highest : MCL Lowest : Reliance Power Critical : Reliance Power, Adani Enterprise, CMPDI, SCCL as their values are less than 2
3	Quick/Acid test Ratio	Highest : MCL Lowest : Reliance Power Critical : Reliance Power, Adani Enterprise as their values are less than 1
4	Cash Ratio	Highest : MCL Lowest : Adani Enterprise Critical : Adani Enterprise, CMPDI, GMDC as their values are low indicating lack of cash
B	***Profitability Indication Ratio***	
5	Gross Profit Margin (In %)	Highest : CIL (Standalone) Lowest : Reliance Power Critical : Reliance Power (Loss), Adani Enterprise (Low value)
6	Operating Profit Margin (In %)	Highest : CIL (Standalone) Lowest : Reliance Power Critical : Reliance Power (Loss), Adani Enterprise, CMPDI (Low value)
7	Net Profit Margin (In %)	Highest : CIL (Standalone) Lowest : Adani Enterprise Critical : Adani Enterprise (Loss), CMPDI, SCCL (Low Value)
8	Return on Assets (In %)	Highest : CIL (Standalone) Lowest : Reliance Power Critical : Reliance Power (Negative value), Adani Enterprise, NLC(Low Value)
9	Return on Investment (In %)	Highest : SCCL Lowest : Adani Enterprise Critical : Adani Enterprise (Negative value), CMPDI (No Investment), Reliance Power (Low Value)
10	Return on Equity (In %)	Highest : CIL (Standalone) Lowest : Adani Enterprise Critical : Adani Enterprise (Negative value), Reliance Power, NLC (Low Value)

11	Return on Capital Employed (In %)	Highest : CIL (Standalone) Lowest : Reliance Power Critical : Reliance Power (Negative value), Adani Enterprise, GMDC (Low Value)
C	***Debt/Liabilities Ratio***	
12	Debt Ratio	Highest : CMPDI Lowest : Reliance Power Critical : CMPDI, CIL (Consolidated), MCL. SCCL (High Values)
13	Debt Equity Ratio	Highest : CMPDI Lowest : Reliance Power Critical : CMPDI, SCCL, MCL (High Values more than 2)
14	Capitalization ratio	Highest : SCCL Lowest : CMPDI Critical : SCCL, NCL, Adani Enterprise (High value indicating more long term debt)
15	Cash flow to Debt Ratio	Highest : CIL (Standalone) Lowest : Reliance Power Critical : Reliance Power, Adani Enterprise, CMPDI (Low values)
D	***Operating Performance Ratio***	
16	Receivables Turnover Ratio	Highest : CIL (Standalone) Lowest : NLC Critical : NLC, CMPDI, Adani Enterprise (Low Values)
17	Fixed Asset Turnover Ratio	Highest : CIL (Standalone) Lowest : NLC Critical : NLC, GMDC, Reliance Power (Low Values)
18	Inventory Turnover Ratio	Highest : CMPDI Lowest : Reliance Power Critical : Reliance Power(No Inventory), MCL, SCCL (Low Values)
19	Operating Ratio	Highest : Reliance Power Lowest : CIL (Standalone) Critical : Reliance Power, Adani Enterprise, SCCL (High Values)
20	Total asset Turnover Ratio	Highest : CMPDI Lowest : Reliance Power Critical : Reliance Power (Very Low in 2013), NLC, GMDC (Low Value)

Table 4.19: Comparative Analysis of the Coal mining companies from Graphs & Results

CHAPTER 5
INVESTMENT ANALYSIS BY CAPITAL BUDGETING METHODS

PROJECT CONSIDERED: LAJKURA OCP EXPANSION
(NORMATIVE CAPACITY 2.50 MTY, 1.50 MTY INCREMENTAL)

5.1 INTRODUCTION

The Project Report for Lajkura Opencast, 1.00 Mty capacity of Ib valley coalfield was prepared in March, 1980 and sanctioned by Govt. in August, 1983 for a capital of Rs 25.79 crore. The min started coal production from 1984-85. The project was completed in March, 1991. Subsequently another report viz. PR of Lajkura Extension OCP (1.00 Mty) was prepared in December 1999 since the dragline commissioned in the mine had balance life and coal seams were continuing in the dip side. The extension PR was approved on March 2002 for a capital of Rs 3.22 crore. Dragline and shovel-dumper system of mining are used in the mine.

The proposal of Lajkura OCP Expansion (2.50 Mty) (1.50 Mty) was prepared as per the Annual Plan of 2008-09. Additional area in the dip side was proposed to be included in the proposal. The normative and peak production of the project are 2.50 Mty and 3.00 Mty respectively. In this PR the Lajkura OCP Expansion was formulated for 3 variants which are mentioned below.

VARIANT 1: Incremental OB departmental & incremental coal outsourcing for life

In this variant incremental OB has been proposed to be carried out by departmental means. Incremental coal production of 1.50 Mty will be done by outsourcing as per the general practice.

VARIANT 2: Incremental OB outsourcing for 5 years (year 2 to year 6) & incremental coal outsourcing for life

In this variant incremental OB has been proposed to be outsourced upto 5^{th} year and then proposed to be carried out by departmental means beyond 5 years upto the end of the mine. Incremental coal production of 1.50 Mty will be done by outsoucing as per the present practice.

VARIANT 3: Incremental OB & coal outsourcing for life

In this variant both incremental OB and coal has been proposed to be outsourced upto the end of the mine life as per the present practice.

5.2 Investment Analysis of Variant 1 Lajkura OCP Exp (2.5 Mty) (1.5 Mty Incr)

Table 5.1: Statement showing Unit cost estimate of Variant 1									
Sl No	**Particulars**	**Total Cost (Rs/t)**	**Fixed Cost (Rs/t)**	**Variable Cost (Rs/t)**	**OB Cost (Rs/cum)**	**OB Cost (Rs/t)**	**Coal Cost (Rs/t)**	**CHP Cost (Rs/t)**	**Comn Cost (Rs/t)**
1	Salaries, Wages & Benefits	55.64	55.64		7.62	26.56	2.11	1.54	25.43
2	Stores	159.58	81.49	78.08	41.00	142.88	5.12	0.53	11.04
3	Power	20.46	15.34	5.11	1.18	4.11	0.57	6.60	9.18
4	Misc exp incl w/s debits	17.34	9.11	8.23	2.62	9.14	0.27	0.53	7.40
5	Admin charges	25.83	25.83						25.83
6	Int on wkg cap @ 14.50%	13.48	9.06	4.42	2.53	8.83	0.39	0.44	3.81
7	Int on loan cap @ 11.50%	0.00	0.00		0.00	0.00	0.00		0.00
8	Depreciation	70.16	70.16		15.70	54.72	0.89	2.00	12.55
	Sub-Total	342.48	266.63	95.84	70.66	246.24	9.35	11.65	95.24
9	Comn cost apportioned to OB & Coal				23.35	81.39	13.86		-95.24
10	Contractual loading and tpt cost (Face to Surface 2-3 km)	28.31		28.31			28.31		
11	Wagon loading cost	5.86		5.86			5.86		
12	Int on wkg cap @ 14.50 %	1.65	0.00	1.65	0.00	0.00	1.65	0.00	
	Sub Total	35.82	0.00	35.82	23.35	81.39	49.68	0.00	0.00
	All Inclusive Cost	398.30	266.63	131.66	94.01	327.63	59.02	11.65	0.00

Table 5.2: Statement of Cost & Profitability At various Levels for Variant 1					
Serial No	**LEVEL OF PRODUCTION %**	**80**	**85**	**90**	**100**
1	Production (mt)	1.20	1.28	1.35	1.50
2	Variable cost/t (Rs)	131.66	131.66	131.66	131.66
3	Fixed Cost/t (Rs)	333.29	313.69	296.26	266.63
4	Total Cost/t (Rs)	464.96	445.35	427.92	398.30
5	Cap investment/annual output (Rs)	641.35	603.62	570.08	513.08
6	Present sp/t (Rs)	464.14	464.14	464.14	464.14
7	Profit (Rs)	-0.81	18.79	36.22	65.84
8	ROI (gross before charging interest on loan capital) %	-0.13	3.11	6.35	12.83
9	BEP % (mt)				80.20 1.20
Capital Employed : 7696.14 lakh Rs **Equity Employed : 7696.14 lakh Rs** **Loan Capital : 0** **Sale Price per ton : 464.14 Rs**					

Table 5.3: Cash flow for Economic Analysis of Variant 1(On Fixed Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	-737	1554	-3641	3535	2187	2466	1844	1977
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	2870	-306	3166	1074	3114	3454	2797	3669	246
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	3582	2935	3202	3450	3556	4584	1825	4708	3434

EIRR = 85 %

Table 5.4: Cash Flow Statement @100% capacity for Variant 1 (On Fixed Cost Basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	3875	0	1464	5339	3548	7.50	-1792
3	3821	0	2947	6767	6995	15.00	228
4	7455	0	5774	13228	6995	15.00	-6233
5	130	41	6051	6222	8535	18.40	2314
6	927	0	6369	7295	8082	17.40	787
7	349	0	6427	6776	7946	17.10	1170
8	1117	41	6397	7554	7946	17.10	392
9	131	864	6394	7388	7946	17.10	558
10	0	518	6320	6839	8399	18.10	1561
11	0	4533	6332	10865	8445	18.20	-2420
12	26	167	6333	6526	8445	18.20	1919
13	986	1779	6375	9139	8445	18.20	-695
14	0	213	6377	6590	8445	18.20	1855
15	0	0	6335	6335	8581	18.50	2246
16	0	1009	6094	7103	8535	18.40	1432
17	0	213	5970	6184	8671	18.70	2487
18	0	4492	5970	10463	8671	18.70	-1792
19	40	173	6134	6347	8716	18.80	2369
20	0	1022	6133	7156	8716	18.80	1561
21	0	689	6134	6823	8716	18.80	1894
22	0	387	6125	6512	8716	18.80	2204
23	40	213	6126	6379	8716	18.80	2337
24	0	19	5592	5611	9124	19.70	3514
25	0	3653	5800	9453	9441	20.40	-12
26	0	2	5791	5793	9396	20.30	3602
Residual		-4293		-4293	0	0	4293
	18897	15737	145761	180395	206173	444.20	25778

NPV = ₹ 52.70 lakh

FIRR = 12 %

PI = 0.006

Table 5.5: Statement showing the estimated total completion cost for Variant 1					
Serial No	**Particulars**	**Completion Cost**	**Yearwise phasing of Capital**		
			Year 1	**Year 2**	**Year 3**
1	Land	2017.48		949.79	1067.69
2	Buildings				
2.1	Service	290.89		141.41	149.48
2.2	Residential	362.24		176.24	186.00
3	Plant & machinery				
3.1	HEMM	2704.33		1270.01	1434.32
3.2	Other than HEMM	1392.18		783.15	609.03
4	Furniture & Fittings	0.00		0.00	0.00
5	Railway sidings	0.00		0.00	0.00
6	Vehicles	55.53		27.02	28.51
7	Exploration	54.23		26.38	27.84
8	Development				
8.1	Capital outlay	0.00		0.00	0.00
8.2	Roads & culverts	624.89		304.04	320.86
8.3	Water supply & sewarage	289.92		141.05	148.87
8.4	Scientific Research	35.79		17.41	18.38
8.5	PR preparation cost	41.48		21.11	20.37
9.1	Rev exp (Coal+OB) capitalized	2		2	
9.2	Less depr capitalized in dev period	0		0	
10	Environment & ecology				
10.1	Environmental & ecology cost	475.98		232.17	243.81
10.2	Land Reclamation	0.00		0.00	0.00
	TOTAL	8363.48		4091.33	4255.15

Table 5.6: Cash flow for Economic Analysis of Variant 1(On Completion Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	-910	1206	-3641	3502	2187	2466	1844	1977
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	2870	-306	3166	1074	3114	3454	2797	3669	246
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	3582	2935	3202	3450	3556	4584	1825	4708	3434

EIRR = 65 %

Table 5.7: Cash Flow Statement @100% capacity of Variant 1(On completion cost basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	4091	0	1464	5555	3548	7.50	-2008
3	4255	0	2947	7202	6995	15.00	-207
4	7455	0	5774	13228	6995	15.00	-6233
5	130	41	6051	6222	8535	18.40	2314
6	927	0	6369	7295	8082	17.40	787
7	349	0	6427	6776	7946	17.10	1170
8	1117	41	6397	7554	7946	17.10	392
9	131	864	6394	7388	7946	17.10	558
10	0	518	6320	6839	8399	18.10	1561
11	0	4533	6332	10865	8445	18.20	-2420
12	26	167	6333	6526	8445	18.20	1919
13	986	1779	6375	9139	8445	18.20	-695
14	0	213	6377	6590	8445	18.20	1855
15	0	0	6335	6335	8581	18.50	2246
16	0	1009	6094	7103	8535	18.40	1432
17	0	213	5970	6184	8671	18.70	2487
18	0	4492	5970	10463	8671	18.70	-1792
19	40	173	6134	6347	8716	18.80	2369
20	0	1022	6133	7156	8716	18.80	1561
21	0	689	6134	6823	8716	18.80	1894
22	0	387	6125	6512	8716	18.80	2204
23	40	213	6126	6379	8716	18.80	2337
24	0	19	5592	5611	9124	19.70	3514
25	0	3653	5800	9453	9441	20.40	-12
26	0	2	5791	5793	9396	20.30	3602
Residual		-4293		-4293	0	0	4293
	19548	15737	145761	181045	206173	444.00	25127

NPV = ₹ -429.12 lakh

FIRR = 11 %

PI = -0.055

5.3 Investment Analysis of Variant 2 Lajkura OCP Exp (2.5 Mty) (1.5 Mty Incr)

Table 5.8: Statement showing Unit cost estimate of Variant 2									
Sl No	**Particulars**	**Total Cost (Rs/t)**	**Fixed Cost (Rs/t)**	**Variable Cost (Rs/t)**	**OB Cost (Rs/cum)**	**OB Cost (Rs/t)**	**Coal Cost (Rs/t)**	**CHP Cost (Rs/t)**	**Comn Cost (Rs/t)**
1	Salaries, Wages & Benefits	48.15	48.15		6.56	22.85	2.11	1.52	21.64
2	Stores	140.39	71.84	68.55	35.99	125.43	5.12	0.53	9.30
3	Power	20.08	15.06	5.02	1.16	4.03	0.57	6.60	8.88
4	Misc exp incl w/s debits	15.57	8.10	7.47	2.34	8.14	0.27	0.53	6.63
5	Admin charges	25.83	25.83						25.83
6	Int on wkg cap @ 14.50%	12.08	8.17	3.92	2.23	7.76	0.39	0.44	3.49
7	Int on loan cap @ 11.50%	0.00	0.00		0.00	0.00	0.00		0.00
8	Depreciation	67.97	67.97		13.59	47.39	0.89	2.00	17.71
	Sub-Total	330.07	245.11	84.96	61.86	215.58	9.35	11.65	93.50
9	Comn cost apportioned to OB & Coal				22.93	79.89	13.60		-93.5
10	OB outsourcing cost	26.74		26.74	7.97	26.74			
11	Contractual loading and tpt cost (Face to Surface 2-3 km)	28.31		28.31			28.31		
12	Wagon loading cost	5.86		5.86			5.86		
13	Int on wkg cap @ 14.50 %	2.94		2.94	0.37	1.29	1.65	0.00	0.00
	Sub Total	63.85	0.00	63.85	30.97	107.92	49.42	0.00	-93.5
	All Inclusive Cost	393.92	245.11	148.81	92.83	323.51	58.77	11.65	0.00

Table 5.9: Statement of Cost & Profitability At various Levels of Variant 2					
Serial No	**LEVEL OF PRODUCTION %**	**80**	**85**	**90**	**100**
1	Production (mt)	1.20	1.28	1.35	1.50
2	Variable cost/t (Rs)	148.81	148.81	148.81	148.81
3	Fixed Cost/t (Rs)	306.39	288.37	272.35	245.11
4	Total Cost/t (Rs)	455.20	437.18	421.16	393.92
5	Cap investment/annual output (Rs)	361.62	340.35	321.44	289.30
6	Present sp/t (Rs)	464.14	464.14	464.14	464.14
7	Profit (Rs)	8.94	26.96	42.99	70.22
8	ROI (gross before charging interest on loan capital) %	2.47	7.92	13.37	24.27
9	BEP % (mt)				77.73 1.17
Capital Employed : 4339.49 lakh Rs **Equity Employed : 4339.49 lakh Rs** **Loan Capital : 0** **Sale Price per ton : 464.14 Rs**					

Table 5.10: Cash flow for Economic Analysis of Variant 2(On Fixed Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	714	2934	1316	1539	848	-1569	1757	2766
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	3310	3314	2359	1006	389	3489	3125	3833	3836
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	2417	2033	860	3750	3696	4595	4240	4033	1941

EIRR = Very High

Table 5.11 Cash Flow Statement @100% capacity of Variant 2 (On Fixed cost basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	2288	0	1240	3527	3548	7.50	20
3	2052	0	2990	5042	6995	15.00	1953
4	1159	0	5872	7031	6995	15.00	-36
5	2449	41	6226	8715	8535	18.40	-180
6	2521	0	6448	8968	8082	17.40	-886
7	5915	0	5910	11826	7946	17.10	-3879
8	1255	41	6388	7664	7946	17.10	283
9	30	0	6371	6401	7946	17.10	1545
10	0	0	6289	6289	8399	18.10	2110
11	0	41	6300	6341	8445	18.20	2104
12	26	1209	6299	7534	8445	18.20	911
13	986	1901	6339	9225	8445	18.20	-781
14	0	3669	6327	9996	8445	18.20	-1552
15	0	0	6291	6291	8581	18.50	2289
16	0	631	6062	6693	8535	18.40	1842
17	0	41	5938	5979	8671	18.70	2692
18	40	0	5935	5976	8671	18.70	2695
19	0	1700	6103	7804	8716	18.80	913
20	0	2183	6100	8284	8716	18.80	433
21	0	3651	6099	9750	8716	18.80	-1034
22	40	0	6098	6138	8716	18.80	2578
23	0	110	6095	6205	8716	18.80	2511
24	0	36	5561	5597	9124	19.70	3527
25	0	666	5769	6435	9441	20.40	3006
26	0	878	5760	6637	9396	20.30	2759
Residual		-2426		-2428	0	0	2426
	18761	14373	144789	177923	206173	444.20	28249

NPV = ₹ 3239.32 lakh

FIRR = cannot be determined

PI = 0.746

Table 5.12: Statement showing the estimated total completion cost of Variant 2					
Serial No	**Particulars**	**Completion Cost**	**Year wise phasing of Capital**		
			Year 1	**Year 2**	**Year 3**
1	Land	2017.48		949.79	1067.69
2	Buildings				
2.1	Service	0.00		0.00	0.00
2.2	Residential	155.02		73.87	81.14
3	Plant & machinery				
3.1	HEMM	164.98		0.00	164.98
3.2	Other than HEMM	853.55		657.32	196.23
4	Furniture & Fittings	0.00		0.00	0.00
5	Railway sidings	0.00		0.00	0.00
6	Vehicles	0.00		0.00	0.00
7	Exploration	54.23		26.38	27.84
8	Development				
8.1	Capital outlay	0.00		0.00	0.00
8.2	Roads & culverts	610.90		295.49	315.41
8.3	Water supply & sewarage	289.92		141.05	148.87
8.4	Scientific Research	35.82		16.89	18.93
8.5	PR preparation cost	41.48		21.11	20.37
9.1	Rev exp (Coal+OB) capitalized	1		1	
9.2	Less depr capitalized in dev period	0		0	
10	Environment & ecology				
10.1	Environmental & ecology cost	475.98		232.17	243.81
10.2	Land Reclamation	0.00		0.00	0.00
	TOTAL	4699.89		2414.60	2285.29

Table 5.13: Cash flow for Economic Analysis of Variant 2(On Completion Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	613	2747	1316	1506	848	-1569	1757	2766
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	3310	3314	2359	1006	389	3489	3125	3833	3836
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	2417	2033	860	3750	3696	4595	4240	4033	2776

EIRR = Very High

Table 5.14:Cash Flow Statement @100% capacity of Variant 2(On completion cost basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	2415	0	1240	3654	3548	7.50	-107
3	2285	0	2990	5275	6995	15.00	1720
4	1159	0	5872	7031	6995	15.00	-36
5	2449	41	6226	8715	8535	18.40	-180
6	2521	0	6448	8968	8082	17.40	-886
7	5916	0	5910	11826	7946	17.10	-3879
8	1255	41	6388	7664	7946	17.10	283
9	30	0	6371	6401	7946	17.10	1545
10	0	0	6289	6289	8399	18.10	2110
11	0	41	6300	6341	8445	18.20	2104
12	26	1209	6299	7534	8445	18.20	911
13	986	1901	6339	9225	8445	18.20	-781
14	0	3669	6327	9996	8445	18.20	-1552
15	0	0	6291	6291	8581	18.50	2289
16	0	631	6062	6693	8535	18.40	1842
17	0	41	5938	5979	8671	18.70	2692
18	40	0	5935	5976	8671	18.70	2695
19	0	1700	6103	7804	8716	18.80	913
20	0	2183	6100	8284	8716	18.80	433
21	0	3651	6099	9750	8716	18.80	-1034
22	40	0	6098	6138	8716	18.80	2578
23	0	110	6095	6205	8716	18.80	2511
24	0	36	5561	5597	9124	19.70	3527
25	0	666	5769	6435	9441	20.40	3006
26	0	878	5760	6637	9396	20.30	2759
Residual		-3469		-3469	0	0	3469
	19122		144789		206173	444.20	

NPV = ₹ 2972.15 lakh

FIRR = 1504 %

PI = 0.68

5.4 Investment Analysis of Variant 3 Lajkura OCP Exp (2.5 Mty) (1.5 Mty Incr)

Table 5.15: Statement showing Unit cost estimate of Variant 3									
Sl No	**Particulars**	**Total Cost (Rs/t)**	**Fixed Cost (Rs/t)**	**Variable Cost (Rs/t)**	**OB Cost (Rs/cum)**	**OB Cost (Rs/t)**	**Coal Cost (Rs/t)**	**CHP Cost (Rs/t)**	**Comn Cost (Rs/t)**
1	Salaries, Wages & Benefits	13.86	13.86		0.86	2.99	2.11	1.52	7.22
2	Stores	10.93	3.54	7.39	0.00	0.00	5.12	0.53	5.28
3	Power	16.05	12.03	4.01	0.00	0.00	0.57	6.60	8.88
4	Misc exp incl w/s debits	6.60	3.30	3.30	0.23	0.80	0.27	0.53	5.00
5	Admin charges	25.83	25.83						25.83
6	Int on wkg cap @ 14.50%	3.54	2.83	0.71	0.05	0.18	0.39	0.44	2.52
7	Int on loan cap @ 11.50%	0.00	0.00		0.00	0.00	0.00		0.00
8	Depreciation	11.23	11.23		0.00	0.00	0.89	2.00	8.34
	Sub-Total	88.04	72.62	15.42	1.14	3.97	9.35	11.65	63.08
9	Comn cost apportioned to OB & Coal				15.47	53.90	9.18		-63.08
10	OB outsourcing cost	204.04		204.44	64.83	204.44			
11	Contractual loading and tpt cost (Face to Surface 2-3 km)	28.31		28.31			28.31		
12	Wagon loading cost	5.86		5.86			5.86		
13	Int on wkg cap @ 14.50 %	11.53		11.53		9.88	1.65		
	Sub Total	250.14	0.00	250.14	80.30	272.19	54.34	11.65	0.00
	All Inclusive Cost	338.18	72.62	265.56	81.44	272.19	54.34	11.65	0.00

Table 5.16: Statement of Cost & Profitability At various Levels of Variant 3					
Serial No	**LEVEL OF PRODUCTION %**	**80**	**85**	**90**	**100**
1	Production (mt)	1.20	1.28	1.35	1.50
2	Variable cost/t (Rs)	265.56	265.56	265.56	265.56
3	Fixed Cost/t (Rs)	90.78	85.44	80.69	72.62
4	Total Cost/t (Rs)	356.33	350.99	346.25	338.18
5	Cap investment/annual output (Rs)	360.59	339.38	320.53	288.47
6	Present sp/t (Rs)	464.14	464.14	464.14	464.14
7	Profit (Rs)	107.81	113.15	117.90	125.97
8	ROI (gross before charging interest on loan capital) %	29.90	33.34	36.78	43.67
9	BEP % (mt)				36.57 0.55
Capital Employed : 4327.12 lakh Rs **Equity Employed : 4327.12 lakh Rs** **Loan Capital : 0** **Sale Price per ton : 464.14 Rs**					

Table 5.17: Cash flow for Economic Analysis of Variant 3(On Fixed Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	16	2894	3630	3116	2942	2875	2000	2851
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	3182	2368	3122	2412	3027	3319	3251	3541	3667
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	3681	3239	3505	3610	3956	4588	4698	4676	522

EIRR = Very High

Table 5.18: Cash Flow Statement @100% capacity of Variant 3 (On Fixed cost basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	2307	0	2083	4390	3548	7.50	-842
3	2020	0	3071	5091	6995	15.00	1904
4	975	0	3195	4170	6995	15.00	2825
5	349	41	6352	6742	8535	18.40	1793
6	62	0	6290	6352	8082	17.40	1730
7	50	0	6217	6267	7946	17.10	1679
8	1017	41	6303	7361	7946	17.10	586
9	0	0	6297	6297	7946	17.10	1649
10	30	0	6417	6448	8399	18.10	1952
11	0	41	6356	6397	8445	18.20	2047
12	0	148	6431	6579	8445	18.20	1865
13	1012	0	6454	7466	8445	18.20	978
14	0	230	6468	6698	8445	18.20	1747
15	0	0	6502	6502	8581	18.50	2078
16	0	0	6529	6529	8535	18.40	2006
17	0	41	6299	6340	8671	18.70	2331
18	0	0	6183	6183	8671	18.70	2488
19	40	0	6183	6223	8716	18.80	2493
20	0	387	6386	6773	8716	18.80	1943
21	0	267	6176	6443	8716	18.80	2274
22	0	40	6271	6311	8716	18.80	2406
23	40	294	5552	5886	8716	18.80	2830
24	0	12	5594	5606	9124	19.70	3518
25	0	35	5827	5862	9441	20.40	3580
26	0	41	5792	5833	9396	20.30	3563
Residual		-653		-653	0		653
	7903	965	145231	154098	206173	444.20	52074

NPV = ₹ 11,349.68 lakh

FIRR = 247 %

PI = 2.62

Table 5.19: Statement showing the estimated total completion cost of Variant 3					
Serial No	**Particulars**	**Completion Cost**	**Year-wise phasing of Capital**		
			Year 1	**Year 2**	**Year 3**
1	Land	2017.48		949.79	1067.69
2	Buildings				
2.1	Service	0.00		0.00	0.00
2.2	Residential	152.92		73.87	79.05
3	Plant & machinery				
3.1	HEMM	164.98		0.00	164.98
3.2	Other than HEMM	840.78		676.71	164.07
4	Furniture & Fittings	0.00		0.00	0.00
5	Railway sidings	0.00		0.00	0.00
6	Vehicles	0.00		0.00	0.00
7	Exploration	54.23		26.38	27.84
8	Development				
8.1	Capital outlay	0.00		0.00	0.00
8.2	Roads & culverts	610.84		296.94	314.30
8.3	Water supply & sewarage	289.92		141.05	148.87
8.4	Scientific Research	35.82		16.89	18.93
8.5	PR preparation cost	41.48		21.11	20.37
9.1	Rev exp (Coal+OB) capitalized	0		0	
9.2	Less depr capitalized in dev period	0		0	
10	Environment & ecology				
10.1	Environmental & ecology cost	475.98		232.17	243.81
10.2	Land Reclamation	0		0	0
	TOTAL	4684.93		2435.01	2249.92

Table 5.20: Cash flow for Economic Analysis of Variant 3(On Completion Cost Basis)									
Year No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Net Cash Flow	0	-86	2710	3630	3083	2942	2875	2000	2851
Year No	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Net Cash Flow	3182	3268	3122	2412	3027	3319	3251	3541	3667
Year No	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Res value**
Net Cash Flow	3681	3239	3505	3610	3956	4588	4698	4676	522

EIRR = Very High

Table 5.21:Cash Flow Statement @100% capacity of Variant 3(On completion cost basis)							
Year	**Capital Expenditure**	**Repl Capital**	**Rev Expenditure**	**Total Outflow**	**Sales Receipt**	**Prod lakh te.**	**Net Flow (In lakh)**
1	0			0			0
2	2435	0	2083	4518	3548	7.50	-971
3	2250	0	3071	5321	6995	15.00	1674
4	975	0	3195	4170	6995	15.00	2825
5	349	41	6352	6742	8535	18.40	1793
6	62	0	6290	6352	8082	17.40	1730
7	50	0	6217	6267	7946	17.10	1679
8	1017	41	6303	7361	7946	17.10	586
9	0	0	6297	6297	7946	17.10	1679
10	30	0	6417	6448	8399	18.10	1952
11	0	41	6356	6397	8445	18.20	2047
12	0	148	6431	6579	8445	18.20	1865
13	1012	0	6454	7466	8445	18.20	978
14	0	230	6468	6698	8445	18.20	1747
15	0	0	6502	6502	8581	18.50	2078
16	0	0	6529	6529	8535	18.40	2006
17	0	41	6299	6340	8671	18.70	2331
18	0	0	6183	6183	8671	18.70	2488
19	40	0	6183	6223	8716	18.80	2493
20	0	387	6386	6773	8716	18.80	1943
21	0	267	6176	6443	8716	18.80	2274
22	0	40	6271	6311	8716	18.80	2406
23	40	294	5552	5886	8716	18.80	2830
24	0	12	5594	5606	9124	19.70	3518
25	0	35	5827	5862	9441	20.40	3580
26	0	41	5792	5833	9396	20.30	3563
Residual		-653		-653	0	0	653
	8260					436.70	

NPV = ₹ 11,093.95 lakh

FIRR = 200 %

PI = 2.56

5.5 Detailed comparative Investment Analysis of the three Variants

Serial No	Factors	Variant 1	Variant 2	Variant 3
1	**Capital Investment**	76.96	43.39	43.27
2	**Cost of Production (Rs/t)**	398.30	393.92	338.18
3	**Average Selling Price**	464.14	464.14	464.14
4	**BEP (%)**	80.20	77.73	36.57
5	**FIRR at Fixed Cost basis (%)**	12	Very High	247
6	**NPV @12% (Rs. Cr)**	0.52	32.39	113.49
7	**Profitability Index**	0.006	0.746	2.62
8	**Economic IRR at Fixed Cost basis (%)**	85	Very High	Very High
9	**Completion Cost of the project**	87.43	47.00	46.85
10	**FIRR at Completion Cost basis (%)**	11	1504	200
11	**NPV @12% (Rs. Cr)**	-4.29	29.72	110.93
12	**Profitability Index**	-0.055	0.68	2.56
13	**Economic IRR at Completion Cost basis (%)**	65	Very High	Very High

Table 5.22 Comparative Investment Analysis of the three Variants

CHAPTER 6
RISK ANALYSIS BY MONTE CARLO SIMULATION IN THE CASE STUDY

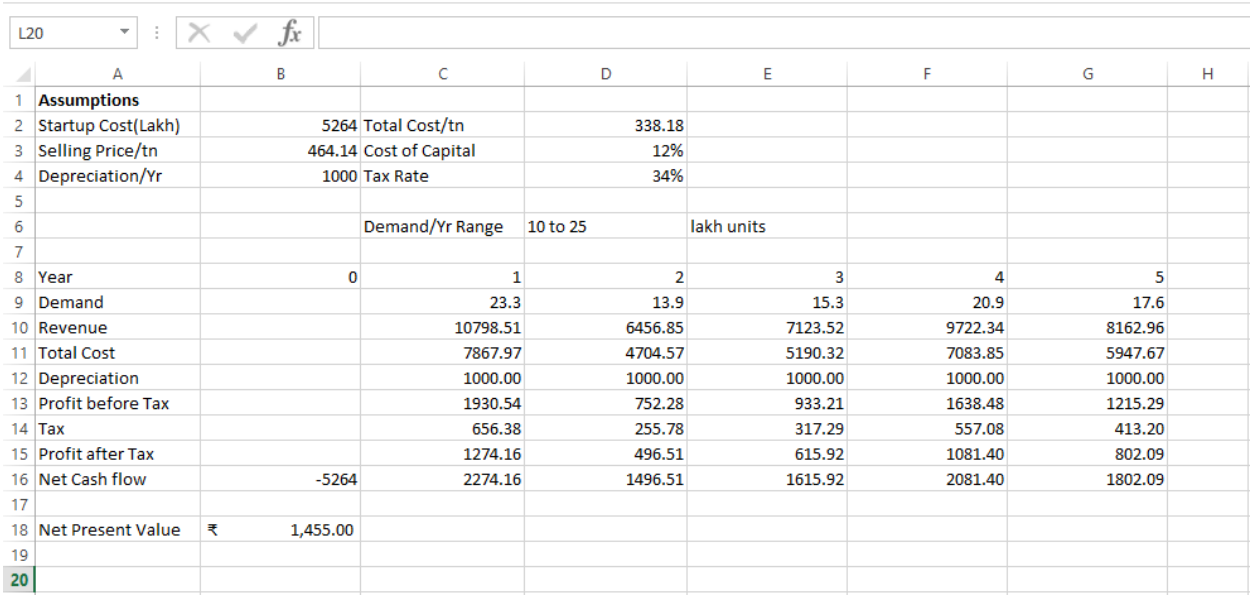
6.1 Statistical Measures for Project Risk

While measuring the risk in cash flows of a project the three main statistical means which are used to evaluate the amount of risk and uncertainty are:

1. The range: It is a statistical measure which represents how apart the two extremes outcomes of a probability distribution are. It is obtained by subtracting the best value from the worst value.
2. The Standard Deviation: It measures how each value obtained deviates from the expected value for the project.
3. The coefficient of Variation: It is the ratio of the standard deviation to the mean of a probability distribution. It translates the standard deviations of different probability distributions so that they can be compared.

6.2 Procedure for the Monte Carlo simulation in capital budgeting risk using Excel

a. The project on which the Monte Carlo simulation need to be done is selected. Here the Variant 3 of Lajkura Project which from the Investment analysis was found to be the best profitable one is selected.
b. Some initial data from the project are taken and also some assumptions are made by following the current trends. The data used here are Startup Cost in lakh Rs, Selling price/tn, Depreciation/year, Total Cost/tn, Cost of Capital and Tax rate.
c. The parameter which is varied is the demand in Mt/ year. As the production of Lajkura is max 2.5 Mt and before it was 1 Mt, so the range is kept 10- 25 lakh ton/ year. The variation is made by the random number generation.
d. As per the demand generated the other parameters like Revenue, Total cost, Profit before tax, tax, profit after tax and net cash flow are calculated for 5 years. For obtaining the net cash flow at the end, the depreciation is added to the profit after tax.
e. From the cash flow data the NPV is obtained using inbuilt excel function.

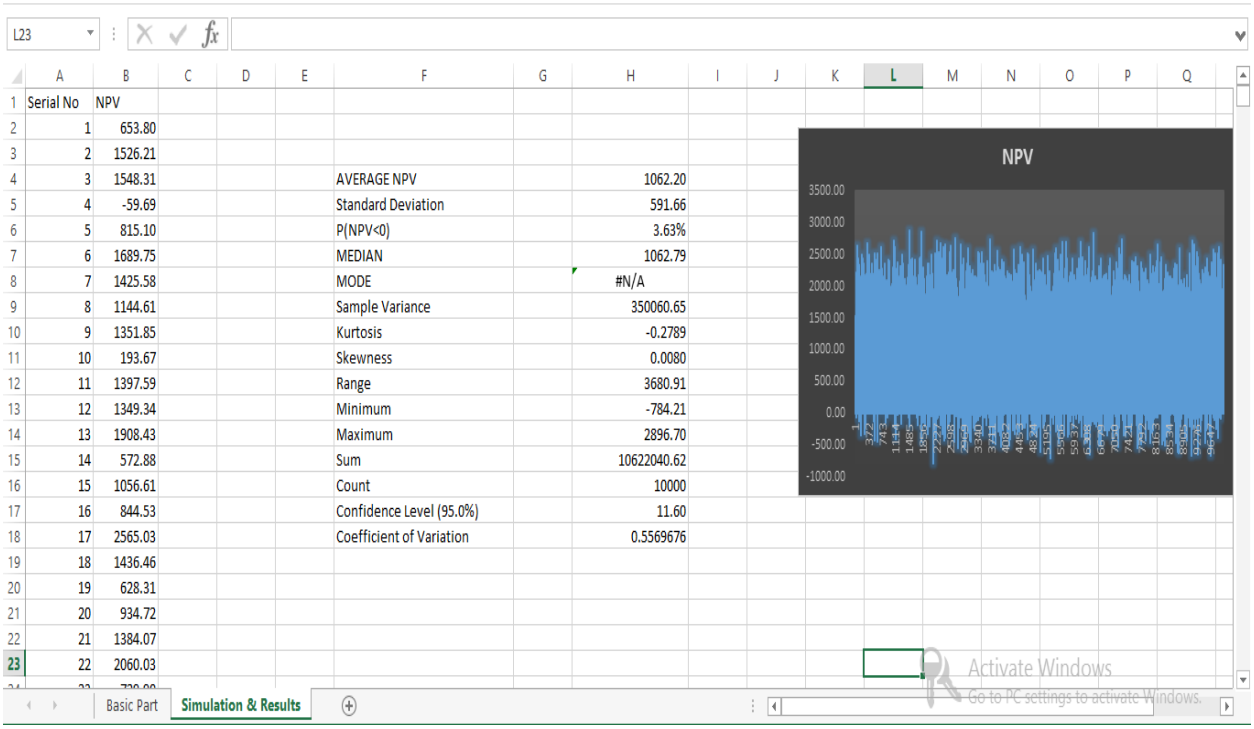


	A	B	C	D	E	F	G	H
1	**Assumptions**							
2	Startup Cost(Lakh)	5264	Total Cost/tn	338.18				
3	Selling Price/tn	464.14	Cost of Capital	12%				
4	Depreciation/Yr	1000	Tax Rate	34%				
5								
6			Demand/Yr Range	10 to 25	lakh units			
7								
8	Year	0	1	2	3	4	5	
9	Demand		23.3	13.9	15.3	20.9	17.6	
10	Revenue		10798.51	6456.85	7123.52	9722.34	8162.96	
11	Total Cost		7867.97	4704.57	5190.32	7083.85	5947.67	
12	Depreciation		1000.00	1000.00	1000.00	1000.00	1000.00	
13	Profit before Tax		1930.54	752.28	933.21	1638.48	1215.29	
14	Tax		656.38	255.78	317.29	557.08	413.20	
15	Profit after Tax		1274.16	496.51	615.92	1081.40	802.09	
16	Net Cash flow	-5264	2274.16	1496.51	1615.92	2081.40	1802.09	
17								
18	Net Present Value	₹ 1,455.00						
19								
20								

Fig 21: Basic procedure and assumptions of the Monte Carlo Simulation

f. Similarly 10000 values of NPV are generated in another sheet of the same file.

g. The inbuilt statistical tools are used on the 10000 NPV data and various statistical outputs are obtained which are useful in risk analysis. Then the probability function graph is plotted.



	A	B	F	H
1	Serial No	NPV		
2	1	653.80		
3	2	1526.21		
4	3	1548.31	AVERAGE NPV	1062.20
5	4	-59.69	Standard Deviation	591.66
6	5	815.10	P(NPV<0)	3.63%
7	6	1689.75	MEDIAN	1062.79
8	7	1425.58	MODE	#N/A
9	8	1144.61	Sample Variance	350060.65
10	9	1351.85	Kurtosis	-0.2789
11	10	193.67	Skewness	0.0080
12	11	1397.59	Range	3680.91
13	12	1349.34	Minimum	-784.21
14	13	1908.43	Maximum	2896.70
15	14	572.88	Sum	10622040.62
16	15	1056.61	Count	10000
17	16	844.53	Confidence Level (95.0%)	11.60
18	17	2565.03	Coefficient of Variation	0.5569676
19	18	1436.46		
20	19	628.31		
21	20	934.72		
22	21	1384.07		
23	22	2060.03		

Fig 22: Simulation, Statistical tools and Result part of the Monte Carlo simulation

6.3 Statistical results from the simulation

Serial No	Statistical Tool	Output/ Result
1	Average NPV	1062.20
2	Standard Deviation	591.66
3	Coefficient of Variation	0.5569
4	Percentage of negative NPV (NPV<0)	3.63 %
5	Median	1062.79
6	Mode	NA
7	Sample Variance	350060.65
8	Kurtosis	-0.2789
9	Skewness	0.0080
10	Range	3680.91
11	Minimum	-784.21
12	Maximum	2896.70
13	Sum	10622040.62
14	Count	10000
15	Confidence Level (95.0%)	11.60

Table 6.1 Statistical results from Monte Carlo simulation of Variant 3

6.4 Summary from the Risk Analysis using Monte Carlo simulation

From the Monte Carlo simulation of Variant 3, Lajkura Project using 10000 NPV values generated during the simulation, we found that the percentage of NPV to be negative is only 3.63%. The risk involved is 3.63% when the project can have negative NPV and thus lead to loss. The amount of risk involved is less in comparison to the profit made which is shown by the mean value i.e. ₹ 1062.20 lakh. So it is confirmed that the Variant 3 is very safe to be implemented.

CHAPTER 7

CONCLUSION

7.1 Conclusion from the Project Work

- From the Financial Analysis it was found that in terms of liquidity, profitability and operation turnovers, Coal India Limited and MCL were the best two among all the mining companies. So these companies are financially strong to have ample amount of scope to invest for expansion or new projects. Reliance Power and Adani Enterprise were among the weaker companies financially and operation wise out of the 8 considered. So investing in these companies can have a lot of risk involved.
- By the Investment analysis of the three variants of the Lajkura Mines using the capital budgeting techniques like NPV, FIRR, EIRR and Profitability Index it was found that the Variant 3 is the best suited for investment. It is having a NPV of 113.49 lakh (Fixed Cost basis) and 110.93 lakh (Completion cost basis) which are highest among the three Variants. FIRR of 247 % (Fixed Cost basis) and 200% (Completion cost basis) is also among the highest of all the three variants. Same situation is seen with the PI value as 2.62 (Fixed Cost basis) and 2.56 (Completion cost basis) values are the highest among the three variants. So from the capital budgeting methods it was found that the Variant 3 is the most economical and profitable project to be invested among the 3 choices.
- After the investment analysis the risk analysis was carried out using the Monte Carlo Simulation of 10000 NPV data. From the simulation it was found that the risk involved in the Variant 3 of Lajkura is just 3.63% which is very low. The amount of risk involved is less in comparison to the profit made which is shown by the mean value i.e. ₹ 1062.20 lakh. Also the confidence level at 95% is 11.60 which is a positive value. So it is confirmed that the Variant 3 is the safest among the three variants and can be implemented with a higher confidence for success.
- So all the aspects were analyzed and finally concluded that the investment in the Variant 3 of Lajkura Mine of Ib valley MCL was the most suitable one of projects in terms of financial, economic and risk factors.

7.2 Future Scope of Work/Research

- The Real Option method in place of the traditional capital budgeting method can be used to find more accurate results for an investment project analysis.
- Other financial ratios (mainly the Dividend and Shareholder's ratios) could be used to predict the financial health of companies at market level.
- Monte Carlo simulation can be used to other economic factors of the projects. Hence more accurate results can be obtained about the projects risk, return and reliability.
- Monte Carlo simulation in other softwares can be used in the Real Option technique for the Investment Scenario analysis.
- Black-Scholes-Merton Model, Binomial model and various other simulation techniques can be used for the financial, investment and risk analysis.
- Financial engineering techniques using WACC, CAPM can be used in the Real Option method.
- Data Mining techniques, neural networks, hybrid methods, decision trees etc. can also be used for the financial and investment analysis of the mining projects in the companies.

CHAPTER 8

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